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MINOR SURGERY;

OR,

HINTS ON THE EVERY-DAY DUTIES OF THE SURGEON.

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Illustrated by Engravings.

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PREFACE.

The shortness of the period usually allotted to a course of lectures on Surgery, and the rapidity with which the lecturer is obliged to pass over the methods of Dressing and the Minor Surgical Operations, has left a deficit in the amount of knowledge required for daily practice, which every one commencing has more or less severely felt. With a view of filling up this, as well as in compliance with the repeated requests of several members of his class, the author has been induced to undertake the present work, not in the expectation of being able to offer any thing new or original on a subject which has so long engaged more or less of the attention of every one, but with the hope that he might afford a concise and methodical system of Minor Surgery, adapted to the wants of the student and young practitioner in the United States.

In doing this, he has drawn freely on the works of MM. Velpeau, Gerdy, Mayor, and others, as

well as upon many practical details obtained from the distinguished Surgeons of the Pennsylvania Hospital during a residence under them in that institution.

In order to facilitate the comprehension of many of the plans herein proposed, a large number of excellent cuts have been furnished by Neville Johnson, which, from their accuracy, will frequently show at a glance what many lines of text could not teach as well.

Should the volume supply, to any young practitioner, that practical assistance of which the author has himself felt the want, it will have fulfilled all that was desired.

HENRY H. SMITH.

No. 117 S. Ninth Street.
August, 1843.

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MINOR SURGERY.

In the strict acceptation of the term, Minor Surgery means that portion of surgery proper, which treats of the minor surgical operations and the employment of such means for the cure of diseases, as do not require the division of our tissues, or, in other words, constitute a *capital operation.* Under this head is, therefore, included the preparation and application of Dressings; the treatment of Fractures and Dislocations, and such minor operations and duties as every Surgeon is hourly called on to perform, and on the proper performance of which rests much of his reputation, as though apparently simple and too often looked upon as matters which any one can attend to, yet in reality difficult, and requiring much method and ingenuity to adapt the means to the end in view.

In the systematic consideration of the subject, four divisions naturally present themselves: — 1st, Dressings; 2d, Bandages; 3d, Apparatus for Fractures and Dislocations; and 4th, Minor Operations.

PART FIRST.

ON THE PREPARATION AND APPLICATION OF DRESSINGS.

Dressings may be defined to be those portions of different substances, which are applied directly to operated or injured surfaces, and are designed to facilitate the reunion of divided parts, to protect them from external injuries, to serve as means for the application of different medicaments, and also to absorb discharges, protect neighbouring parts, and ensure cleanliness.

The different articles employed and the means by which they are applied, are known under the one general head of *Apparatus of Dressing;* and consists of two parts, one containing the *Instruments of Dressing*, the other the *Pieces of Dressing* to be employed.

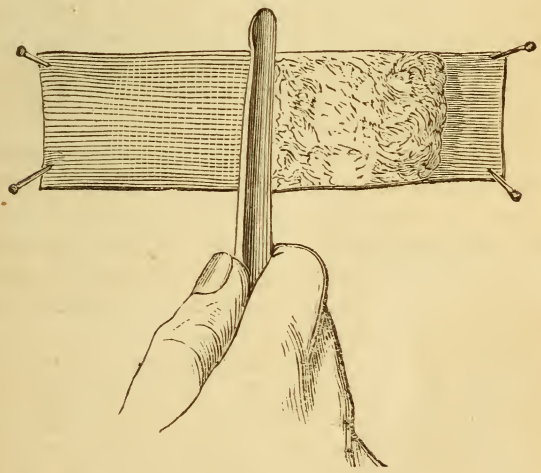
The *Instruments of Dressing* are those which are generally found in the assemblage furnished by the cutlers, and known under the name of the Pocket Case. This contains Dressing or Ring Forceps; Simple Forceps; Scissors, both straight and curved; Probes and Directors; Spatulæ; Bistouries; Abscess Lancets; Porte Caustic; Tenacula; Straight and Curved Needles; Ligatures; and often such others as the taste of the cutler or his interests may lead him to select. Under the same head should also be included

Razors, Basins, Sponges; and all that is requisite for the preparing of a part for the application of the dressing.

The *Pieces of Dressing* are Lint; Charpie; Cotton; Tow; Spread Cerate, or other ointment; Compresses; Malteese Cross; Shields for Amputations; Adhesive Strips; Setons; Poultices; Plasters; and Irrigations.

Lint is a soft, delicate tissue or mass, prepared in two ways; — in one of which the transverse threads of soft old linen are drawn out by a machine, leaving the longitudinal ones covered by a sort of tomentum or cotton-like mass; the other,

Fig. 1.



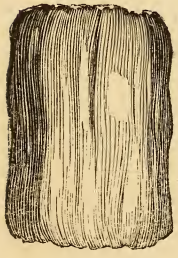
in which the cotton-like surface is produced by scraping, with a sharp knife, a similar piece of cloth, previously fastened to some firm substance.

The first is known as the Patent Lint, and may be obtained at any apothecaries, as it is now generally manufactured; the second, is the Domestic Lint, and may be made at a moment's notice where the first is not convenient. They are both employed as primary dressings, either spread with ointments or alone.

Charpie is a substance much employed by the French surgeons, and worthy of a more general application in the United States. It consists of a collection of filaments, separated from morsels of old linen rag, four or five inches square, of loose texture, and well calculated to absorb. It is divided into two kinds, according to the length and fineness of the thread composing it; that which is long and coarse being employed to keep open sinuses, fistulæ, and as an outer dressing, while the softer, finer kind may be placed in immediate contact with the part, especially where the surface requires stimulation.

Various names are given to charpie, according to the way in which its fibres are arranged, previously to its application; thus there is the Plumasseau, Bourdonnet, Tente, Mèche, Boulette, Tampon, and Pelote; each of which have their peculiar advantages.

Fig. 2.



The *Plumasseau* is a mass of charpie, the filaments of which are laid parallel to each other, and the ends folded under and flattened between the palms of the hands, so as to make a thick mass with rounded edges. As thus

formed, it is usually spread with cerate, and neatly adapted to the parts it is to cover, care being taken that it is not so thick as to overload and heat the part, nor yet so thin as to become quickly saturated with the pus.

The *Bourdonnet* is a smaller mass of charpie, formed by rolling its fibres longitudinally between the hands, so as to make an oblong mass, which is tied firmly in the middle, so that when the ends are brought in contact laterally, it may form a sort of cone. It serves for absorbing pus in deep-seated wounds, where there is a tendency in the edges to close, before the bottom has filled up. It is also useful in arresting hemorrhages from deep-seated vessels; pressure being made by forcing the central part upon the vessel, while the loose tissue made by the ends assists in the formation of the clot.

Fig. 3.

The *Tente* is the name given to conical or cylindrical masses or plugs of charpie, which are like the Bourdonnet, except that instead of applying a string to its middle, it is there doubled on itself and the loose ends twisted by the fingers, so as to give it a spiral form and make the apex of a cone, the base of which is the part where the fibres were doubled on themselves. It is employed to dilate fistulous canals or openings which are too small to allow of the free escape of pus, and answers very well for moderate dilatation.

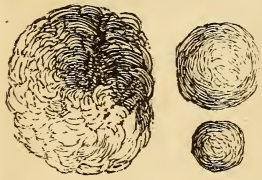
Fig. 4.

But where parts are rigid, the Sponge Tente, or that made by slicing gentian, carrot, or some other porous root, answers better. The *Sponge Tente* is prepared by saturating common sponge with melted bees-wax, allowing it to cool and harden, and then slicing it into small pieces, of such a size as will nearly fill the orifice to be dilated. The heat of the part melts the wax, the sponge fills with the fluids of the part and gradually dilates it: after which a new morsel must be introduced.

Fig. 5.

The *Mèche* is an assemblage of filaments of charpie, arranged parallel to each other and doubled at the centre. It is of great use in the treatment of fistula, especially fistula in ano. When prepared, it is anointed with cerate and introduced into the cavity on the point of a probe; as it prevents the edges from healing, it causes the cavity to fill gradually from below upwards.

Fig. 6.



Boulettes are little balls of different sizes, made by rolling charpie between the hands until it acquires this form. They are extremely porous and absorbent, and are useful in filling up purulent cavities, and preventing the matter from burrowing.

When a number of *Boulettes* are placed together at the bottom of any cavity, either with a view of distending it, or of arresting hemorrhage, they take the name of *Tampon*. They are often

used in gonorrhœal inflammations of the vagina and to arrest uterine hemorrhage; for the latter purpose, especially if the hemorrhage follows an operation, they are made of the Boletus Igniarius, or puff-ball.

Fig. 7.

The *Pelote* is a large boulette, surrounded by a piece of soft rag, the edges of which are brought together and tied firmly. It is occasionally employed in the treatment of herniæ, especially the umbilical hernia of children, where, when bound down by adhesive strips or a bandage, it answers very well the purpose of a truss. It is also useful in the compression of large vessels, as in wounds of the axillary artery, and also in hemorrhage from parts in the neighbourhood of the rectum, being there confined under a T bandage.

Cotton and *Tow* are substances which are too well known to require a description. Both are of comparatively limited utility as dressings, their places being usually supplied by charpie. Before, however, the application of either to surgical purposes, they should be well picked or carded to free them from foreign matters. The chief use of cotton is as a dressing for superficial burns, where it is useful by protecting them from the air and by absorbing the discharges; thus forming a sort of scab under which they readily heal. When intended to be thus used, it is especially necessary to see that it is free even from *specks*, as the fly is exceedingly apt to lay its egg here, where it is vivified by the heat of the body, and generates maggots, to the great annoyance of the

patient and the astonishment of all around him, as they are unable to account for their appearance, and regard it as a fatal sign.

Tow is employed chiefly as an outer dressing to stumps which are discharging freely, as it absorbs well. Care is requisite in forming the *Plumasseau* of *Tow* for this purpose, that it be not too thick and heating, as union is often thus prevented.

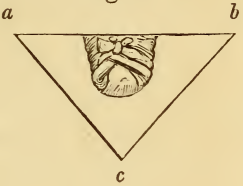
Compresses are pieces of linen which are used for confining dressings in their proper situations; preserving wounds from external injuries; equalising the surface of limbs for the proper adaptation of bandages, and also for the compression of soft parts. They should be made of some soft substance free from hems or darns, and, with one or two exceptions, applied over other dressings. Where they are intended to be placed directly on a wound, they should always be made of soft linen. Compresses have received various names according to the way in which they are folded or the indications to be fulfilled; thus we have the Square, Oblong, Triangular and Cribriform Compress, the Malteese Cross, the Half Malteese Cross, the Single and Double Split Compress, the Perforated, the Graduated, and the Pyramidal Compress.

Fig. 8.

The *Square* compress is that in which the substance used has the same dimensions in its two principal diameters. If it is twice as long as it is broad, and will form a square when doubled in its length, it forms the *Oblong Compress*, and

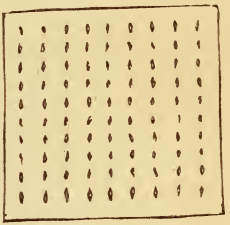
is useful in surrounding the trunk, or limbs. When a square piece of linen is folded so as to unite two of its angles, it forms the *Triangular Compress*, and is exceedingly useful in confining dressings to stumps, when it is desirable to remove the dressing often without deranging the limb. To apply it for this purpose, cut one of such a size as will surround the limb, place the stump in the centre of the side *a b*; then turn up the apex *c*, and afterwards the points *a* and *b*.

Fig. 9.



The *Cribriform Compress* is a square piece of linen pierced with a number of holes, and intended when spread with cerate to be applied directly to a suppurating surface; the pus passing out through the holes allows the compress to remain constantly in contact with the surface, and thus prevents the wound from being constantly bathed in pus. It also assists in the removal of other dressings, by preventing them from sticking to the part. It is formed by folding linen four or six times on itself, so as to form several oblong squares, one within the other, and then nicking the sides in several points with the scissors, so as to remove

Fig. 10.



small pieces; on opening it, we have the form desired.

Fig. 11.

The *Malteese Cross*, so named from its shape, is formed from the common square compress by folding it into an oblong square, doubling this in its length to form a smaller square — joining two of the angles to form a triangle, as in the figure; and folding this equilaterally to form a smaller triangle, then mark a line on its hypothenuse half an inch from its apex, and slit the sides down to this line, which is dotted in the figure. On opening it out we have a very regular cross, with a space in the centre, which is to cover the front of the stump. The cross is of great use as a primary or secondary dressing to stumps, as by means of the slits it will fold over and fit the part very accurately.

Fig. 12.

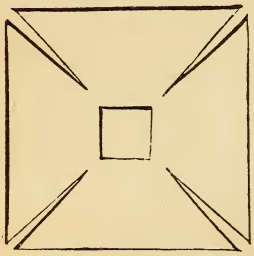


Fig. 13.

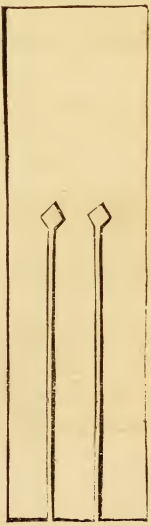
The *Half Malteese Cross* is formed by slitting the two angles of the loose side of an oblong square to within an inch or two of their centre, as seen in the figure, and serves a better purpose than the

full cross, in some cases, as in stumps at the shoulder, or after amputation at the hip-joint, &c.

The *Single Split Compress* is an oblong piece of muslin split as represented in the cut, and intended to be used as a *shield* or *retractor* in amputations of the arm or thigh. The tails are passed on each side of the bone, and drawn downwards while the upper part is turned upwards over the stump, so as to draw the muscles back and protect them from the action of the saw. The diamond shape opening at the end of the split is intended to adapt it more accurately to the bone itself.

Fig. 14.

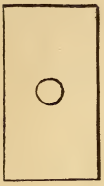
Fig. 15.



The *Double Split Compress*, or *retractor of three tails*, differs from the preceding one only in its being split into three tails instead of two. It is employed with the same view after amputations of the forearm and leg; the third tail being pushed through the interosseous space, protects more thoroughly both the bones of the part.

The *Perforated Compress* (Fig. 16) is the name given to a piece of muslin folded several times on

Fig. 16.



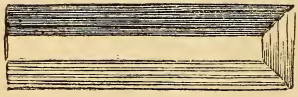
itself so as to make a thick mass, in the centre of which an opening is made. It may be employed to relieve points of pressure, especially where they have a tendency to slough, as on the internal condyle in fractures of the arm, and on the heel in fractures of the lower extremity; the sore point being placed in the centre of the opening, so as to save it, whilst the pressure is borne by the parts on its circumference.

Graduated Compresses are named from their construction, and are of several kinds, the substance of each being folded differently according to the object in view.

Fig. 17.

The *Common Graduated Compress* is formed by folding a piece of muslin several times on itself, so that each fold may not entirely cover the one that has preceded it. It may be graduated from one end, or from the circumference to the centre, as seen in Figures 17, 18.

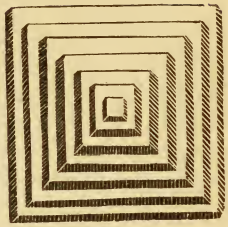
Fig. 18.



The *Pyramidal Compress* is one that is most accurately formed by placing on one another, square pieces of muslin gradually decreasing in size so as to form a pyramid (*Fig.* 19); or by folding a piece of 2½ inch bandage on itself, so as to form a compress graduated from end to end, and then placing a piece

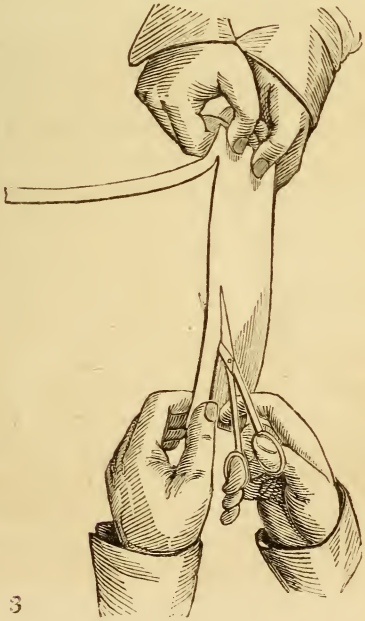
of cork or other body in the centre of the last turns. Thus formed, it is very useful in making pressure upon certain points, as in cases of hemorrhage from deep seated vessels.

Fig. 19.



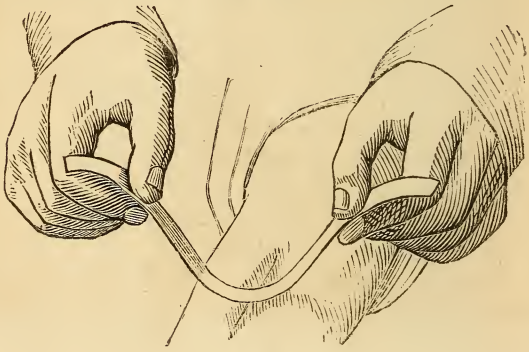
Adhesive Strips are pieces of linen spread with some adhesive plaster, usually diachylon, and intended to promote the union of divided parts. They may

Fig. 20.



be prepared from the sheet on which it is usually spread, by sliding the scissors according to the line of the thread of the cloth and slitting it into pieces about three-quarters of an inch in width (Fig. 20), and of a length sufficient to enable it to extend at least three inches beyond each side of the wound, which is to be united. Before applying them, it is generally necessary to soften the plaster by heat; and the most convenient method of so doing is to fill a bottle with boiling water and wrap the strip around it, the outside of the strip being next the surface of the bottle. In applying it, the strip should be first placed on the portion of the wounded surface that is most depending, so as to draw it up to the other, the intervals between the straps being such as to allow of the free escape of the matter. For removing them, they should be softened by washing the part with warm water, or by applying a warm poultice to it a few hours before the dressing is removed. The surgeon then lays hold of one of the extremities of each piece in succession, and

Fig. 21.



gently raising it, reflects it upon the wound. This extremity being detached to within half an inch of the edges, he detaches the other to about the same distance, and holding them together, lifts them perpendicularly, taking care at the same time to apply the thumb and index finger of the left hand upon the sides of the wound, to prevent injury being done to the cicatrix. (Fig. 21.)

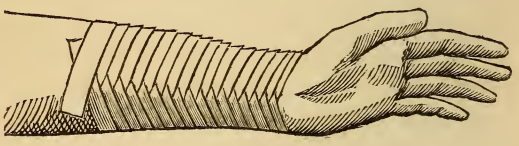
As adhesive strips sometimes irritate and inflame the part, owing to their tearing out the small hairs or down which cover it, their application is frequently followed by erysipelas. In this case their places may be very well supplied by the slit and tail, or uniting bandage hereafter mentioned. Adhesive strips are also very useful as a dressing to ulcers, or for compression in cases of Orchitis or Hernia Humoralis.

As the treatment of ulcers by the use of adhesive strips is of considerable importance, a detailed account of Baynton's plan is here given.

Several strips of adhesive plaster, the manner of preparing which has been already described of about two inches in breadth, and sufficiently long to pass round the limb and leave an end of about four or five inches; several longitudinal compresses made of soft calico, and a calico roller about three inches in breadth, and varying from four to six yards in length, according to the size of the limb, are first prepared. Then one of these strips is to be applied to the sound side of the limb, opposite the inferior part of the ulcer, so that the lower edge may be placed about an inch below the lower edge of the sore, and the ends drawn over the lower part of the ulcer, with as

much gradual extension as the patient can conveniently bear; the other strips are then applied in the same manner, each above and in contact with the other, until the whole surface of the sore and of the limb is covered from one inch below to two or three inches above the affected part.

Fig. 22.



The whole of the leg, if it is the part affected, should then be covered equally with the longitudinal compresses, and the roller applied round the limb, from the toes to the knee, with as much firmness as the patient can support without complaint. One or two spiral turns of the roller should be first passed round the ankle-joint, then as many round the foot as will cover and support every part of it, except the toes, and the same continued up the limb as far as the knee; the roller should be carried from the ankle upwards in reverses, as many of them being made as the parts require, in order that each turn may lie flatly on the limb. Should the parts be much inflamed, or the suppuration very abundant, the applications are to be wetted frequently with cold spring-water. The patient may take exercise if he pleases, as this will be found to alleviate the pain and tend to accelerate the cure. The bandage ought to be daily ap-

plied soon after rising in the morning, when the parts are most free from tumefaction; and the force with which the ends of the plasters are drawn over the limb gradually increased as the parts return to their natural state of ease and sensibility. When the cure is thus far accomplished, the roller should be applied with as much tightness as the patient will bear, more particularly if the limb be in that enlarged or compressible state denominated scorbutic, or if the edges of the wound be thickened.

We may remark, that this bandage is liable to produce excoriations of the limb, but these are never serious except when they occur over the Tendo-Achillis. To prevent them or accelerate their disappearance, Mr. Baynton recommends the application of a small shred of soft leather under the adhesive plaster: or a bit of sheet-lead may be used in place of the shred of leather, as it answers better.

During the years 1830 and 1831, several of the most eminent surgeons of Paris submitted Baynton's method of compression to a series of experiments, which, as the result will show, were highly favourable to it. Velpeau found the average time of cure ten, fifteen, or twenty days, for ulcers of three, four, or five inches in circumference. Ph. Boyer, who perhaps pushed the experiments further than any one else, found the average period of treatment, calculated upon a large number of cases, to be twenty-six days; and this result is so much the more striking, as Duchâtelet was noticing at the same period the average length of time required by the older methods, which he found in six hundred and ninety cases to be fifty-two days

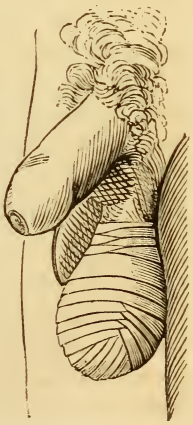
and a half, giving a difference of more than half in favour of Baynton's plan. In the course of these experiments some modifications were introduced; as, for instance, that by Velpeau and Ph. Boyer, of the substitution of good diachylon plaster for the mixture of Baynton. So, with respect to the breadth of the plasters, the above surgeons found them more advantageous when only an inch or an inch and quarter broad. In the course of the experiments, Roux and Ph. Boyer found that the inflammatory state of the ulcer did not counter-indicate the employment of compression, which often arrested, even, its secondary effects. Marjolin, however, recommended the reducing of the inflammation before proceeding to compression. Velpeau and Roux extended the compressive treatment to contused wounds with disorganisation of the skin, which were getting into an atonic state, and also, to every species of wounds with or without loss of substance when the cicatrization was slow, or otherwise checked by a general vice of the constitution, attending, however, in the latter case to internal remedial agents calculated to benefit the system. Ph. Boyer endeavoured to cure syphilitic and scorbutic ulcers by compressive strips alone, but without success; while, by exerting this species of compression, and employing, at the same time, the ordinary internal remedies, the cure was remarkably hastened.

Ph. Boyer's observations all tend to support the opinion of Baynton himself, that, when the leg is properly bandaged, walking, at least moderately, tends to facilitate the cure, and renders it more complete. With regard to the periods of renewing

the bandage, Velpeau found it quite sufficient to change it every three, four, or five days, according to the degree of irritation. Boyer never dressed them oftener than once in forty-eight hours. Valbrune considered it necessary to renew the bandage oftener if the cessation of swelling caused it to become relaxed, but agrees with Velpeau and Boyer in thinking that the less often the bandage is disturbed the better.

It may perhaps be useful to the young surgeon to say that the use of adhesive strips to suppurating surfaces often produces a marked blackness of the skin. This is nothing but a chemical change produced in the plaster by the action of the discharges, and not the forerunner of gangrene as many have at first supposed. Nothing answers so well for a compressive bandage of the testicle in cases of Epididymitis, or chronic enlargement of the testicle, as strips of adhesive plaster. In order to apply them in this case, the swelled testicle should be forced to the bottom of the scrotum, by surrounding the cord with the thumb and fingers of one hand so as to form a ring, while with the other, or with the hand of an assistant, the strips are so applied as to surround the part entirely as seen in Fig. 23. These strips should be of the width of the thumb, and applied over one another from

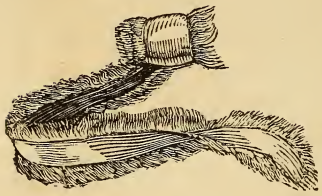
Fig. 23.



below upwards, till the testis and a part of the cord are compressed between them. Previous to their application the parts should be cleansed and well shaved; and the strips should be renewed as often as they become slack from the abatement of the swelling in the testicle.

The *Seton* is a narrow strip of soft linen rag, of one, or one and a half inches in width, with a few of its longitudinal threads drawn out from each side, so as to leave a rough or jagged border, and intended to keep up irritation and suppuration in a part, and thus act as a revulsive from other parts. A skein of silk, a piece of silk braid, or, what is still better, on account of its cleanliness, a strip of gum-elastic, may be substituted. The introduction and dressing of the seton will be treated of hereafter.

Fig. 24.

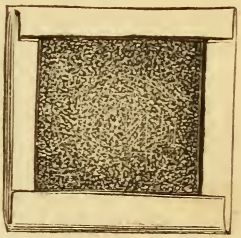


Poultices or *Cataplasms* are different kinds of pulp or pastes intended to cover injured surfaces, and are made of various substances, according as the object is to have an emollient, an astringent, or a stimulating one.

The *Emollient Poultice* may be made of any mild, unirritating substance, as bread and milk; bread and water; bran and water; and ground flaxseed or flaxseed meal. The latter forms decidedly the best poultice, not only as regards its properties, but also its economy. It may be prepared by simply pouring hot water on the *meal*,

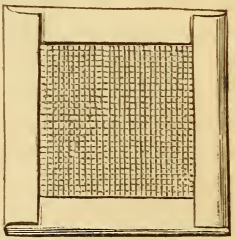
and stirring it till it acquires such a consistence as will prevent its running from its softness, or its drying and breaking off from the reverse. In order to make it, a portion of the paste is dropped on a suitable piece of muslin, and spread of an even thickness, say about one-fourth or half an inch, the free ends of the muslin being folded over so as to form a sort of frame or border, and thus prevents the adhesion of the edges (Fig. 25). If the meal is not fresh, it will be necessary to rub a little sweet oil over the surface of the poultice, or to cover it with a piece of fine gauze previously softened in warm water, to remove its starch, and prevent the adhesion of the poultice (Fig. 26).

Fig. 25.



This, and every other one, should be renewed at least twice in twenty-four hours, or more frequently if it becomes hard and dry. Care must also be taken that the poultice has not fermented, or the oil, if used, become rancid, as it will then irritate instead of soothing the part. The bread and milk, or bread and water poultice, is prepared by breaking the crumb of bread into either of these liquids till they have the proper consistence, when they may be spread and used like the first one.

Fig. 26.



The astringent poultice is formed of the above by adding some astringent article. Frequently it consists of bread and lead-water, or of a curd made by throwing alum into boiling milk, or rubbing it up with the white of egg. These latter should always be covered with gauze, as they are chiefly used in the treatment of affections of the eye.

The *Stimulating Poultice* is formed of various substances, as, boiled carrot, grated down to a pulp; raw potato, grated and applied cold; grated onions; Indian meal and some fermenting liquor, as yeast or porter; or flowers of mustard. The *Fermenting Poultice*, or that made of Indian or corn-meal and porter, should always be spread on or covered with oiled silk, to prevent its evaporation and too rapid drying; and it should, likewise, be covered by the gauze to prevent its adhesion. It is of great use in cases of sloughing, mortification, hospital gangrene, &c.

The *Mustard Poultice* is prepared by mixing flowers of mustard with water to the consistence of that which is commonly employed for the table, and then spreading it very thinly on muslin, and only allowing it to remain on the part till it reddens it — be it five or be it fifteen minutes. The vinegar with which it is sometimes mixed, so far from increasing its powers of stimulation, materially weakens them.

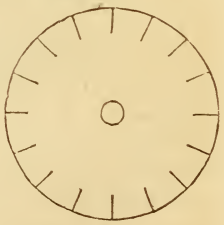
To confine a poultice to a part, some of the bandages hereafter mentioned may be employed at the option of the surgeon.

Plasters are made of various substances, and are occasionally employed to soften indolent tu-

mours, procure their resolution, or hasten their suppuration. In their preparation, the surgeon has no part, as this properly belongs to the apothecary. He may, however, be required to direct the shape of it, in order to ensure its more accurate application. In general, nothing is necessary but to slit the angles which project when the plaster is applied to the surface; but in the plaster for the female mammæ, a peculiar shape is required which may be best obtained thus: — Fold a piece of paper on itself so as to form a perfect square of the size required; fold this so as to make an oblong square; double it and fold its angles so as to make a smaller square; fold this into a triangle, and round off its upper angles as in the dotted line (Fig. 27). Then cut off semicircularly as much at the point as will make an opening large enough to admit the nipple, or more if desired; and slit the sides at the circumference for one inch towards the centre. This when opened out will give the figure required (as in Fig. 28), and will enable any one to prepare a plaster of a proper shape.

Fig. 27.

Fig. 28.



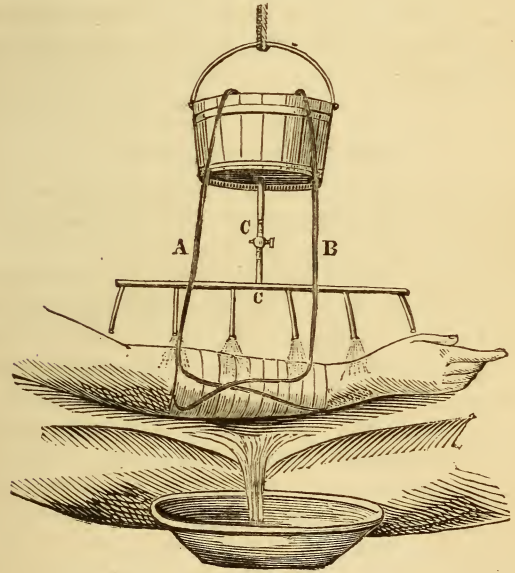
Irrigation, or dressing by imbibition, is the term applied to certain dressings which are intended to keep the parts constantly cool and moist by the use of cold fluids, and thus diminish an excess of inflamma-

tion. In simple erysipelas of some extent, in phlegmonous erysipelas, in compound fractures, in sprains, dislocations, and other injuries to joints, and in cases of sloughing from excessive action after amputations, they afford us a most excellent means of combating the inflammatory action. In order, however, that they may be properly applied, considerable care and attention is requisite on the part of the attendant, for if the stream of the liquid is not kept up steadily, there will be a constant change in the temperature of the part, and a reaction from cold to hot, which must do harm; or there may be too great a degree of cold; or the patient may become wet with the dressing and suffer from cold in some internal organ. The surgeon, therefore, must be particular in the arrangement of the apparatus, in the selection of the case, that it be dependent on an excess of action in the part, in the length of time during which it is continued, and in the proper attention of the assistant. The simplest form in which it can be properly arranged, is that shown in the cut (Figure 29, A B B).

The part to which it is to be applied, is first laid upon a piece of oil cloth or coach-curtain, to prevent the wetting of the bed and clothes of the patient, and this is to be bent on the outer side so as to form a little gutter to carry off the water, after it has gone on the limb, into the vessel placed below. A vessel filled either with cold water, cold lead-water, or other cold lotion, is placed near the bed at such a height as will be most convenient, and from it strips of patent lint twisted to-

gether; or, what is better, a piece of cotton-wick, as A and B, extend to a piece of lint which covers the part affected, and absorbs the liquid brought over. The wick, previous to its application, should be so wet as to absorb readily the fluid in the basin, or, in other words, form a syphon.

Fig. 29.



Another mode of applying irrigation is by means of a tube with a cock, arranged as in the same cut at C, and which may be made at a moment's notice, of a piece of cane-angle and some quills.

If the patient complains of the cold, it is easy, by

means of the cock, to regulate the amount of fluid which shall pass over; and this is the only advantage which it possesses over the syphon, while the simplicity of the latter, and the facility with which it may be made and applied, recommend it strongly to our favour.

Should it be desirable to foment the part, it is only necessary to change the liquids, though the application of warmth can be better made by wringing flannels out of hot water and constantly changing them.

RULES FOR DRESSING.

The observance of the following rules for the application of Dressings will be found to assist us materially in the proper use of them.

1st. Make, or see made, all that is requisite for the new dressing before removing the old one.

2d. Have a sufficient number of aids, to whom special duties shall be assigned before commencing the dressing, as this prevents confusion; thus, in dressing a stump, there should be one to support the limb; another to furnish hot water, and change it as required; heat the adhesive strips, hand cerate, &c., &c., &c., by which means the surgeon can give his attention wholly to his own duty.

3d. Arrange the bed, as a general rule, *after* the dressings are changed; or, if in a case of fracture, *before* the patient is placed on it.

4th. Let the *position of the patient* be such as will be as easy for him as possible, so as to cause him no unnecessary fatigue, and let the surgeon place himself on the outside of the limb, as this gives him more freedom in his movements.

5th. Guard against all hasty and inconsiderate movements on the part of the assistants or of yourself, in order to prevent unnecessary pain to the patient.

6th. If an operation is to be performed, let each assistant understand, before you begin, that he is to confine himself solely to his own duties; thus, one may hand instruments to the operator, another sponge away blood, &c., &c., so that when a tenaculum or other instrument is wanted, there may not be half-a-dozen hands snatching for it, to the great risk of all parties.

PART SECOND.

OF THE PREPARATION AND APPLICATION OF THE BANDAGE.

By Bandaging is generally understood the confinement, in their proper situation, of dressings and other surgical apparatus, or the retaining in their natural position of parts of the body which have been previously displaced, and is generally effected by means of pieces of muslin or other substance, or by mechanical contrivances. The term *Bandage*, in its strict signification, is only applicable to a collection of bands, or to those pieces of stuff which are fastened to one another and employed as a whole, though general usage now justifies its application to the single *Band* or *Roller*. This is a strip of flannel, linen, muslin, calico,

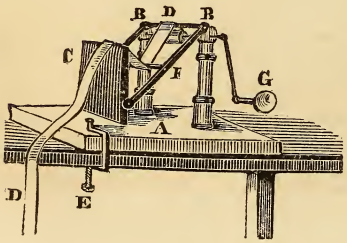
cloth, gum-elastic, or other substance ; and of different lengths and widths according to the object to be attained in its application. As most generally found, it consists of a strip of muslin, eight or ten yards long, one-half, two, two and a half, three, or four inches in width ; free from hems or darns, soft, pliable and unglazed to prevent its slipping. As thus made, bandages are divided into two kinds ; — simple, or those formed by the application of the roller only ; and compound, or those resulting from the complex arrangement of the pieces composing them, as in the double T bandage, &c.

SECTION FIRST.

OF THE SIMPLE BANDAGE, OR THE ROLLER.

The simple roller is prepared from a piece of muslin of the requisite length and width, by tearing it from the piece and then winding it into a cylindrical form, either by the machine or by the hand, so as to form one or two heads, and constitute what is called the Single or Double-headed Roller. The machine for rolling them, one of Dr. Barton's earliest contributions to Surgery, is seen in Figure 30, and consists of a base A, and of two uprights, B B, in which runs a spindle, G, to receive the bandage ; a broader upright, C, to support a move-

Fig. 30.



able frame, F, which, by its pressure, tends to tighten the bandage, D D, as it is rolled, and of a screw, E, to fasten the machine to a table. In order to roll the bandage on this, one extremity of it should be attached to the spindle by wrapping it round it, and the rest wound up by turning the handle with one hand, while the other directs the course of the band and ensures its being wound even; then tear off all the loose threads, as they will not unravel too much if the cylinder is tightly rolled, but will run to waste if it is loose. Thus formed, the *Single-headed Roller* consists of a cylinder with two *extremities;* of an *initial or free end*, of a *terminal* one, or that found in the centre of the cylinder, of two surfaces; an external and an internal, and of a *body*, or portion between the two ends.

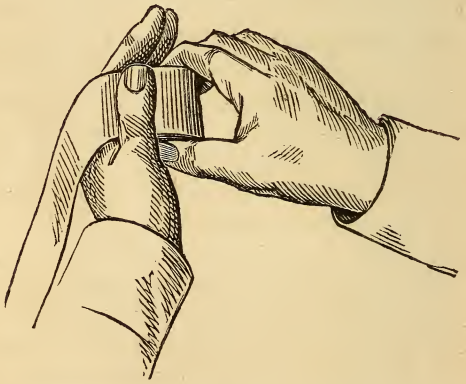
The *Double-headed Roller* has the same parts except the initial end, which is wanting, both ends being here wrapped into cylinders; this roller, therefore, always commences in its application with the body or portion between the two heads.

Fig. 32.

The necessity which exists for the reapplication of the same roller, both from economy and convenience, sometimes compels us to prepare it without the aid of the machine, because, unless a roller is formed into a cylinder, it will be found impossible to apply it properly. In order, therefore, to do

this with the greatest ease, fold the terminal end of the roller five or six times on itself, so as to form a sort of axis or mass; roll this a few times on the thigh to give it size. Then place its two extremities between the thumb and forefinger of the right hand, while the body is allowed to run over the forefinger of the left, where it should be firmly pressed by the thumb of the same hand, so as to make a considerable degree of traction, and tighten the cylinder. Having arranged this, give a rotatory motion to the band, by causing the cylinder to revolve upon its axis by means of the fingers and thumb of the right hand, whilst, at the same time, the left revolves partially around the cylinder itself, which, by this compound movement, is soon formed as required, and as may be well seen in the cut.

Fig. 33.



After a very little practice, it will be found an easy matter thus to roll a bandage with either

hand, almost as quickly and tightly as can be done on the machine.

If the roller is intended for the body, it should be twelve yards long and about four inches wide; if for the head, five yards long by two inches wide; if for the extremities, eight yards in length and two, two and a half, or three inches in width, according to the size of the limb, the thigh requiring one a little wider than that for the leg.

In order to apply this single-headed roller, which is the one most generally employed, it should be held between the thumb and fingers of the right hand, and the cylinder pressed by the fingers against the palm, to prevent its slipping out of the hand as it unrols, which it is apt to do if held; so that its internal surface should be the part first applied to the body. Or it may be held by placing the thumb and first and second fingers of the right hand on the two extremities of the cylinder. In either case the *external surface of the initial end* should be the portion first applied to the part, and should be retained there by the fingers of the left hand until one or two turns are made round it so as to fix it firmly, after which we may proceed upwards. Bandages have been divided into several kinds, from the direction which they take in covering a part, or the object to be attained by their application; thus, we have the Circular, the Oblique, the Spiral, the figure of 8, the Spica, the Recurrent; and we have also the Uniting, Dividing, Compressing, Expulsive, Retaining, &c., including those of both the Simple and Compound Bandages.

The *Circular* is that formed by horizontal turns

of the roller, each of which overlaps, or very nearly overlaps, the one which preceded it.

In the *Oblique*, the turns gradually ascend the limb or pass obliquely to its axis.

The *Spiral* mounts still more;—the *Spica* forms a figure like the leaves of corn; and in the *Recurrent* the folds run back to the point whence they started.

The *Uniting Bandage*, named from its action, is that which is used in incised wounds; it should be adapted to their direction according as they take a longitudinal or transverse course more or less complete: for longitudinal wounds it is constructed with a double-headed roller, the breadth of which ought to correspond to the length of the wound: a longitudinal slit being made in the body, in order to allow the surgeon, when applying the bandage, to pass through it one head of the roller, and thus bring together the edges of the wound; this bandage often takes the form of a spica. Or it may be made for such wounds with a single-headed roller, by dividing it at one end to a convenient distance into three tails, and making a little way beyond the termination of these, three longitudinal openings to receive them. The uniting bandage for transverse wounds consists of two strong linen bands of the width of the wound, and as long as the member; one of these is to be split about half its length into two or three tails or bandelets, and the other perforated in the middle with three corresponding longitudinal openings, as will be seen in the consideration of these bandages hereafter.

The *Dividing Bandage* is that which is used to prevent the formation of seams or unsightly cicatrices in the treatment of burns, and of wounds attended with great loss of substance.

The *Compressing Bandage* is that employed for exerting compression in sprains, œdematous swellings, callous ulcers, varices, aneurisms, erectile tumours, &c.

The *Expelling Bandage* is employed in the treatment of ulcers, deep-seated abscesses, contused wounds, &c. It is composed of a roller applied over graduated compresses, upon the region wherein the pus or blood is lodged, to which it is desired to give issue: it prevents these fluids from insinuating themselves along the interstices of the muscles, and detaching the skin from its adherence to the subjacent parts, or forming sinuses.

Retaining Bandages are those which serve to confine dressings and displaced parts in their proper situation. Into this class enter herniary bandages, and those for fractures and dislocations.

A bandage which does not give the most perfect support to the parts, maintain them in the position necessary to ensure the fulfilment of the indication proposed, and exert on the member an equable compression, is useless, or worse than useless, as it may produce such a state of things as may eventuate in the loss of the limb or even of life. When, therefore, it is applied too tight, or when the compression is not uniform, very serious consequences may arise, such as œdematous swellings, and even mortification: their proper application is, therefore, a matter of great importance.

In the department of surgery which constitutes

the subject of this part of the work more perhaps than in any other, is the practitioner's reputation exposed to the severity of criticism; and on the degree of knowledge and dexterity which he evinces in this, as attested by the greater or less acuteness of the patient's sufferings, the duration of the treatment, and the issue of the case, will be found to depend the favourable or unfavourable general opinion of his talents: the majority of people can usually well appreciate what is palpable to the senses in the practice of the healing art, and therefore it is not surprising that they here exercise their privilege of criticism to its utmost limits.

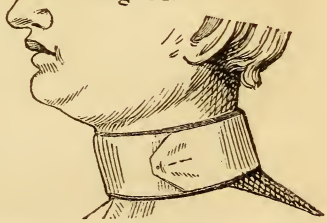
Those who, from want of practice, cannot produce the neat appearance of a well applied bandage, and thus escape the remarks often made in regard to it by those around the patient, are frequently induced, in order to effect it, to resort to the wetting of the roller, as it then adapts itself much more readily to the part. But this should never be done except in the treatment of Dislocations, unless we would wish to expose a patient to the risks of mortification; for it is impossible for any one to calculate exactly how much a wet roller will shrink in drying, and consequently how great a degree of pressure it may make on a part, after we have left them. A bandage may be of the proper degree of tightness, and the patient make no complaints, and yet in three or four hours be suffering such agonies as must be seen or felt to be properly appreciated. The question, then, may very properly be asked, as to how much traction should be made in order to apply a roller properly. This will, to a certain extent, depend on the ob-

ject with which it is applied, as a bandage which is merely intended to confine a dressing, need not be as tight as one that is to compress the muscles; but, as a general rule, a *dry* bandage is not too tight if the patient feels easy under it two or three hours after its application; but, until practice has taught the degree to which a roller should be drawn, the fact should be recollected that one which is too tight must do serious injury, while all that can result from one that is too loose, will be the non-fulfilment of the indications for its application. The young surgeon had, therefore, better err in the latter case, as daily evidence shows that the tendency of all young dressers is to use too much traction on a bandage, and not too little.

In the consideration of the special application of the roller we shall take up, 1st, its application according to the course which it may take; and 2d, that resulting from the object to be attained in its application, commencing with the head and proceeding regularly to the toes.

The *Circular* bandage is one, as has been said, in which each turn overlaps that which has preceded it, so that the whole looks like a single turn, and runs directly round the part. All the circular bandages are very simple, and consist of one for the forehead, in which the turns encompass the vault of the cranium; one

Fig. 34.



for the eyes, used to retain dressings after the operation for cataract; one for the neck, as in the dressing of blisters, setons, &c.; one for the arm, as in the compression of the veins previous to bleeding; and a few of a like nature for other parts of the body, as may be readily understood.

In the confinement of the terminal end of the circular, or any other bandage, two means are employed,—either the use of pins, or of little bands tied in bow-knots.

If pins are used, they should be placed either in the direction of the length or breadth of the band. If in its length, the head should always be turned from the free end of the roller, as otherwise the tendency of the roller to become loose will, by constantly drawing against the head, at last withdraw the pin entirely. On the other hand, if it is applied transversely, the head should always present to the upper extremity of the limb, in order to prevent its sticking in the fingers of the surgeon when his hand is passed down the part either to smooth the turns of the roller, or in its removal to seek for the end. (Fig. 37.) A reference to Fig. 36 will show how the pin may be drawn out by the unwinding of the roller itself. Some persons prefer

Fig. 35.

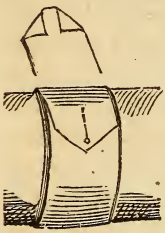


Fig. 36.

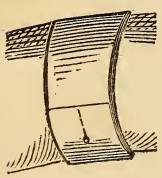
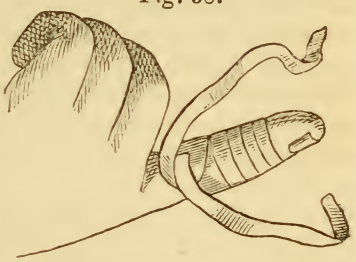


Fig. 37.

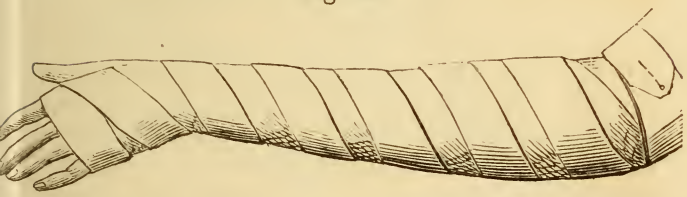
to fasten the end of a roller by means of a piece of tape, or by slitting the end for a short distance into two strips and tying the pieces in a bow-knot; but this is never as neat and firm as the pin, except in the bandaging of fingers, toes, &c.

Fig. 38.



The *Oblique Bandage* differs from the circular in the direction of its turns, by which it is enabled to cover in a greater extent of surface, each turn being a little beyond the one previously made and following a course oblique to the axis of the limb. It is chiefly employed to retain dressings,

Fig. 39.

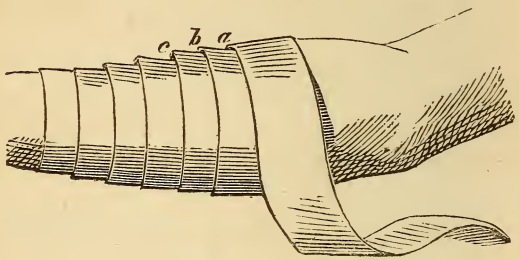


though occasionally useful when conjoined with other bandages in certain cases, which will be spoken of further on.

The *Spiral* is the bandage most frequently employed in the treatment of diseases of the extremities as well as in those of the trunk. Its turns are

not so oblique as the one last spoken of, as each turn covers in at least one-third of the one below it. As most of the parts to which it is applied are conical, it follows that, in the ascent from the lower to the upper part of them, especially in the extremities, we must pass from the apex of the cone to its base, and that consequently one edge of the body of the roller will press on the part, while the other will project beyond it, and form what are known under the name of Gaps, as *a*, *b*, *c*. To obviate

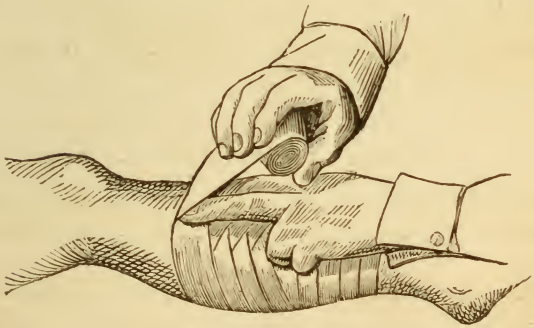
Fig. 40.



this and cause the bandage to apply itself perpendicularly to the whole surface of the part, the roller must be half folded on itself, or a doubling made, which is called a *Reverse*. As the bandage by this action acquires an increased thickness, a greater degree of pressure will be made on these points than at any other, and it is therefore desirable, in order to obviate the bad effects which might result from it, that the reverse should be as short and as smooth as possible. To do this, hold the roller in the position in which it is generally applied,

that is, either by its body or its two extremities, the hand being in a state of supination; the fingers of the other hand are then applied to that part of the body of the bandage which is already in contact with the limb, not to assist in forming the reverse, or to fold it down, but simply to prevent its slipping while the reverse is being made. Thus fixed, we should see that no more of the band is unrolled than will enable us to separate the hand a short distance from the limb, say three or four inches; and then *keeping all slack* between the fingers which fix the body of the roller and the part which is in the cylinder, turn the hand holding

Fig. 41.



the cylinder from supination into decided pronation (Fig. 41)—taking care to make *no traction*, nor to sink the cylinder below the level of the limb till the fold or reverse is made, when we may again proceed up the limb. These reverses are indis-

pensable wherever there is an increase in the size of the part, from the extra development of certain muscles; and it is therefore of the greatest importance that the proper way of making them should be acquired, as no spiral bandage can proceed four inches on an extremity without requiring a reverse. Although generally regarded as the most difficult point in the application of the roller, it is not so in reality, and a little attention to the rules, recollecting always that *no traction is to be made*, nor the cylinder sunk below the limb, or widely separated from it, while the reverse is forming, will enable any one after a little practice to make them with great ease and neatness. To add to the latter, they should, as far as possible, be kept in a perpendicular line, as seen in the cut of the spiral of the lower extremity.

The special applications of the Spiral Bandage are as follows: —

SPIRAL OF THE CHEST.

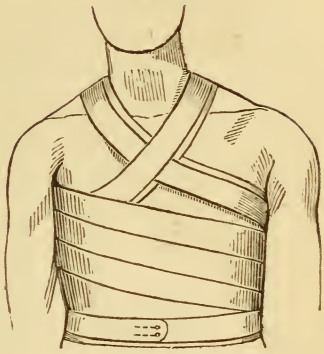
This is composed of a single-headed roller, ten or twelve yards long, and three or four inches wide.

Position of the Patient. — Always sitting up, so that the hand of the surgeon may pass readily behind the back.

Application. — The initial end is applied to the anterior part of one axilla, say the left; and the roller is then conducted upwards across the front of the chest, passes over the right clavicle, and over the back to the point of departure;

another and similar turn being effected, it is then carried across the front of the chest to the right axilla, to form an oblique from this to the left clavicle, after which it is carried firmly around the chest in spiral turns from above downwards.

Fig. 42.



Use. — In fractures of the ribs, care being taken to apply compresses to their anterior and posterior extremities, if the fragments project inwards; but if outwards, upon the parts themselves. It is sometimes useful to add to this the T bandage for the body, as seen hereafter, in order to prevent the roller from slipping, if the patient, from mania à potu or other causes, should be very restless.

SPIRAL OF THE ABDOMEN.

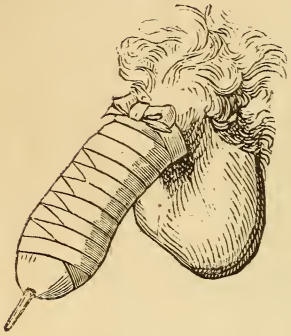
Composed of the same parts as the above.

Application. — Commencing at the lower part of the chest, carry the roller spirally round the abdomen from above downwards.

Use. — To compress the abdomen, in certain cases, as after the operation for tapping in ascites. Its place may be well supplied by the double T of the abdomen.

SPIRAL OF THE PENIS.

Fig. 43.



Composed of a band of eighteen or twenty-four inches in length, half an inch wide, and slit into two pieces at its terminal extremity.

Application. — Commence at the base of the glans penis, and form an ordinary spiral which shall terminate at the root of the penis, and be confined by tying the two ends.

Uses. — This is chiefly employed to retain dressings to the penis, in cases of chancres and other sores external to the prepuce. It has also been used in the treatment of gonorrhœa, in order to compress the urethra, a catheter being left in it; but it is very apt to produce erections, which do harm, and quickly derange the bandage. The sheath of the penis spoken of hereafter, answers better.

The application of the Spiral Bandages to the Arm or the Forearm, is usually merely to retain a dressing, and may be very well included in the application of the spiral to the whole limb, as the turns in either case are the same.

SPIRAL OF THE FINGERS.

Composed of a roller one yard long, one inch wide, and split, or not, as may be, into two ribbons, at its terminal extremity.

Application. — Fix the initial extremity round

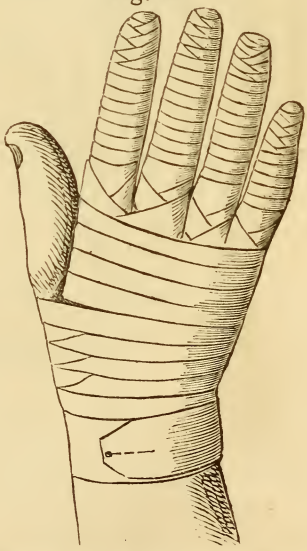
the wrist by a circular turn and cross the back of the hand to descend either finger to its extremity by very oblique turns. Commencing at its extremity, make an ordinary spiral with reverses, and terminate the bandage either by a knot or by a pin, with a few circular turns round the wrist, as seen in Fig. 38.

Use. — The spiral turns of this little bandage are employed by every one to retain dressings to the finger in cases of wounds, but without the turns round the wrist it is very apt to become deranged.

SPIRAL OF ALL THE FINGERS, OR GAUNTLET.

Composed of a band, eight yards long and one inch wide, rolled in a cylinder.

Fig. 44.



Application. — Commence the bandage by one or two circulars around the wrist; pass obliquely over the back of the hand, and by oblique turns descend to the nail of the forefinger; then by spiral reversed turns, ascend to its base; pass to the middle finger; descend by oblique turns to its nail; ascend by spirals to its base, and so on, till all the fingers are covered in, terminating at the base of the little finger, then pass in front or on the back of the hand to finish by circulars around the wrist.

Use.—We may resort to this bandage when more than one finger is injured, and there is reason to fear their uniting if they are permitted to come in contact, as in cases of burns. To this should be added the demi-gauntlet, double T of the hands, or perforated T, if there is a necessity for retaining dressings at the metacarpal extremities of the fingers.

DEMI-GAUNTLET.

Fig. 45.

Composed of the same as the preceding.

Application.—Make a few circular turns around the wrist and pass across the back or palm of the hand, as the case may be, by oblique turns which will pass from the root of each finger to make a circular turn round the wrist.

Uses. — To retain dressings to the front or back of the hand. Its place may be well supplied by the perforated T, or the double T of the hands.

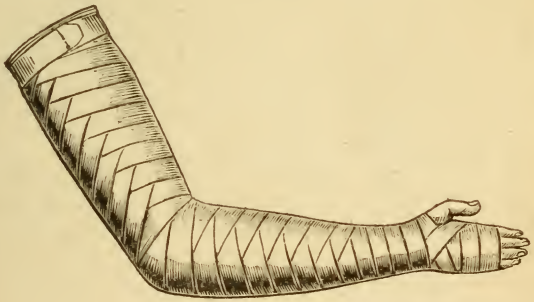
SPIRAL OF THE UPPER EXTREMITY.

Composed of a roller, eight yards long, two or two and a half inches wide, and compresses, if it is required as a Compressing Bandage.

Application. — Having covered in the fingers

if necessary by the gauntlet, commence with one or two circular turns around the wrist, in order to fix the end of the bandage, then pass obliquely over the back of the hand and palm, to reach the extremities of the fingers, ascend by three spiral turns without reversing, which brings us to the phalangeo-metacarpal joint of the thumb ; cover this and the wrist-joint by a figure of 8, as will be described hereafter, and ascend the limb by spiral and reversed turns, till we reach the elbow ; cover this also by a figure of 8, if the arm is to be flexed, if not, by simple spiral turns without reverses, and continue the spiral and reverses to the shoulder, placing compresses, &c., where they may be required.

Fig. 46.



Use. — To cover in, support, and compress the whole limb, as in varicose veins, aneurismal tumours, treatment of fractures, &c.

Position of the Patient. — Sitting, or lying down, with the arm and forearm extended, and the palm of the hand looking forwards, the thumb being widely separated from the hand.

The effects of this bandage, when well applied, are excellent; but it may become very fatiguing and painful if drawn tight, and if *too* tight, may produce gangrenous ulcers of the skin. In 1837 it was found necessary in the Pennsylvania Hospital to amputate the forearm of a man who had had only a simple fracture of the lower extremity of the radius, but whose arm was gangrenous from the mal-application of this bandage by a country surgeon.

The spiral of the thigh, of the leg, of the foot, and of the toes, are similar to the above, and may therefore, be included in the

SPIRAL OF THE LOWER EXTREMITY.

Composed of two simple rollers, each eight yards long and two and a half inches wide.

Position of the Patient. — If possible, seated with the extremity of his heel on the very point of the surgeon's knee, or else laying down, and the leg supported by assistants. The surgeon may be either at the foot, or on the *outside* of the limb, and either sitting or standing.

Application. — Commence by making one or two circular turns, immediately above the malleoli, to fix the end of the roller, then descend, if in the right foot, from the external malleolus obliquely across the instep and under the sole to the extremity of the little toe; from this make two or three oblique turns which will cover in the foot as far as the instep, and then cover in the heel by turns of the figure of 8, one extremity of the eight embracing the heel and ankle, the other the instep; after which, ascend the limb by spiral reversed turns, which may be made with either hand, until

you reach the knee. Cover in this joint by a figure of 8, and proceed with the second roller to make spiral reversed turns on the thigh, till the whole is covered in.

Uses. — This bandage, if well applied, fulfils every indication either in the treatment of fractures, ulcers, varicose veins, or œdema, and will usually keep its place, if the patient remains in bed, for two or three days. The main difficulty in its application consists in the covering in of the heel. This is not absolutely necessary, as the close adhesion of the integuments to the parts below, prevents any great amount of swelling; but where a considerable degree of compression is made on the leg, it is a better plan to cover in the heel entirely. To do this, proceed from the inside of the instep of the right foot under the heel to its outside, then around its point to the inside, forming a cap for the heel, round under the sole of the heel up across the instep, to go round the point to the opposite side and come up over the outside of the ankle, then over the instep, under the sole, up over the ankle in front, over the internal malleolus, round to the external, and then up the limb. The turns on the heel and foot are seen in the figure. The advantages of the circular turns round the ankle in commencing this bandage, are, that it gives greater firmness by preventing the initial end from becoming loose. The French surgeons, however, usu-

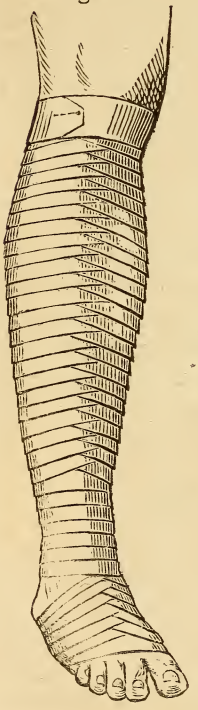
Fig. 47.

ally begin it at the toes, and do not cover in the heel, and their course may be pursued by those who may deem it best, by observing the rules for the application of the

FRENCH SPIRAL.

Composed of a roller, two and a half inches wide and seven yards long.

Fig. 48.



Application. — Place the initial extremity on the outside of the instep, say of the right foot, and pass obliquely across to the ball of the big toe under the sole to the extremity of the little toe, and then make as many spiral reversed turns as will carry us to the front of the ankle, or the front of the astragalus. Pass from this around the malleoli, and ascend the limb by spiral reverses, as in the former bandage. The reverses of this and the former bandage being the same, are shown in this figure, the only difference being in the turns to cover in the heel.

Uses. — Same as the ordinary spiral. This bandage is the one best adapted for the application of the *Dextrine* or *Starch* Bandage, as it leaves the toes and heel open to inspection, as will be seen in the treatment of fractures. Where it is necessary to make pressure on the instep, heel, and ankle, the

spica of the foot may be added to this with advantage.

THE CROSSED, OR FIGURE OF 8 BANDAGES,

Compose some of the best and neatest applications of the roller, and are so named from their shape. They are exceedingly useful in covering in joints and other points which require a firm and solid compression, and are made both with the single and double-headed roller, though, as the compression resulting from the turns of the latter is sometimes very painful and requires watching, it is seldom used in this country.

CROSSED OF ONE EYE.

Composed of a single-headed roller, two inches wide and five yards long.

Application. — If the hair is long, cover in the head first with a nightcap to prevent the first turns of the roller from slipping, and then make two or three circulars round the forehead and occiput; passing from right to left if for the left eye, and the reverse if for the right. Then on reaching the nape of the neck in the third turn, carry the roller under the ear of the affected side, and then obliquely up over the jaw and the injured eye, inclining it well to the internal canthus, so as to cover the root of the nose, but not affect the sound eye; pass hence across to the temple of the sound eye; descend to the nape of the neck,

Fig. 49.

and make thus two or three oblique turns (*a a a*), and terminate by circular ones around the forehead (*b b b*).

Use. — This answers tolerably well to retain dressings to the eye, but is very readily displaced by the movements of the patient. When, therefore, it is important to make pressure on the ball of the eye, as in the treatment of gonorrhœal ophthalmia, cancer, &c., &c., it is better to cover in both eyes by the use of the following, or else employ the simple circular bandage of the eyes.

CROSSED OF BOTH EYES.

Composed of a single or double-headed roller, seven yards long and two inches wide, with compresses, if required.

Application. — Make two or three circular turns of the head, turning indifferently from right to left, or the reverse; then reaching the back of the neck, pass under the ear of one side, up over the eye, root of nose, and parietal protuberance of the opposite side, to return to the neck. Make two or three turns like this, and at the third pass from the parietal protuberance round the forehead instead of round the occiput, to cross the root of the nose, the eye, and cheek of the opposite side, making an X with the first turns; proceed in oblique turns as before, and terminate by circular ones.

Uses. — This is much more solid than the former, and may be employed in similar cases. It adds much to its solidity to cover in the head, after its application, with a handkerchief or nightcap.

CROSSED OF THE ANGLE OF THE JAW.

Composed of a single-headed roller, two inches

wide and five yards long, and of a thick compress.

Application. — Carry the initial portion of the bandage around the forehead, and fix it by two circulars of the vault of the cranium, turning from the right to the left and backwards, if the disease is on the left side: from the nape of the neck, direct the roller close under and behind the ear of the sound side, under the jaw to the angle of the jaw on the injured side, placing the compress behind and on this angle. Then carry the roller over the compress, up over the side of the face, between the eye and left ear, obliquely over the vertex, and down behind the ear opposite the injured side. Make thus three or four oblique turns, as seen on the right side of the figure, and terminate by circular turns around the forehead.

Fig. 50.

Use. — This is an excellent bandage for the treatment of fracture of the neck and angle of the jaw, as it forces the angle forwards to the anterior portion. It is also useful in tumours of the parotid gland, and generally in retaining dressings to this region. No circular turns should be made

around the chin and neck, as sometimes recommended in cases of fracture of this part of the jaw, as these tend to displace the fragments, and push the chin too much backwards.

CROSSED, OR FIGURE OF 8 OF THE JAW.

Barton's Bandage.

Composed of a single-headed roller, five yards long and two inches wide.

Fig. 51.

Application. — Place the initial extremity of the roller just below the prominence in the os occipitis, continue it obliquely over the centre of the parietal bone, across the junction of the coronal and sagittal sutures, over the zygomatic arch under the chin, and, pursuing the same direction on the opposite side until you arrive at the back of the head; then pass it obliquely around and parallel to the base of the lower jaw, over the chin, and continue the same course on the other side till it ends where you commenced, whence we run exactly the same course, fixing the bandage by a pin at the vertex.

Use. — For this beautiful specimen of a bandage we are indebted to the skill and ingenuity

of Dr. J. Rhea Barton, of Philadelphia, a surgeon to whom the profession owe many very important and novel operations, and whose skill in the use of bandages is unsurpassed by any one. It is an admirable dressing for fractures of the lower jaw, anterior to its angle, and requires but one or, at most, two pins, which is a great advantage. In order to apply it neatly, the roller should not be over *two inches wide*, and the turns should follow as nearly as possible those which have preceded them, thus giving the appearance of but a single turn.

CROSSED, OR POSTERIOR 8 OF THE CHEST.

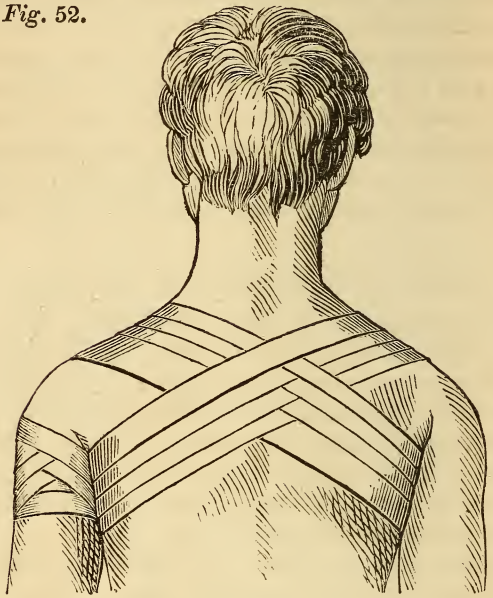
Composition. — A roller, five yards long, two and a half or three inches wide, and compresses, or cotton, to place on the anterior edge of the axillæ to prevent the bandage from chafing them.

Position of the Patient. — Sitting with the shoulders well drawn back by one assistant, whilst another retains the compresses on the axillæ till after the first turns of the roller.

Application. — Carry the initial extremity of the roller around the superior part of one arm, as the left, and make three or four spiral reversed turns from before backwards, and from within outwards. From this shoulder pass obliquely over the back to the right axilla, the shoulders being well forced backwards. Ascend in front of, and over the shoulder, to pass over the back to the left axilla, over the compresses in front of this and round to the back, over it to the right axilla, over it in front, and over the back to the left

axilla, to pass again the same course till the roller is nearly exhausted, when it may be terminated by circulars of the body, or of the right arm.

Fig. 52.



Use. — This bandage may be either a uniting one for the back, or a divisive one for the front of the chest. It was formerly employed in the treatment of fractured clavicle, but its place has been supplied by others, though it may occasionally be a useful addition to the ordinary dressings, where it is requisite to carry the shoulder well backwards. It is also useful in longitudinal wounds of the back, or in preventing contractions from burns on the front of the chest.

ANTERIOR 8, OR CROSSED OF THE FRONT OF THE CHEST.

This is precisely the same as the former, but in regard to the opposite points of the body. Its composition and application can therefore be readily understood from the figure, and what has been just said. It draws the shoulders forwards — of course, would unite longitudinal wounds over the pectoral muscles, and prevent contractions in the cicatrices of burns of the back. By placing compresses over the upper part of the sternum, it may also be usefully employed in injuries of this part.

Fig. 53.

SPICA OF THE SHOULDER.

Composed of a roller, eight yards long, two and a half inches wide, and of cotton, or a compress, for the axilla of the injured side.

Application. — Commence the bandage by making one or two spiral reversed turns round the upper part of the arm of the injured side, passing from without inwards, and from before backwards: pass from behind the arm up over the lower extremity of the shoulder, obliquely downwards over the front of the chest to the axilla of the sound side; thence round the back obliquely upwards, over the shoulder, and down it in front under the axilla of the injured side, previously furnished with a compress or cotton; then behind and upon the shoulder to pursue exactly the same course, covering in, however, only one-third of the preceding turn, until the bandage is nearly exhausted, when it may be terminated by one or two circulars of the trunk or of the arm, or pinned, as in the cut.

Fig. 54.

Uses. — This neat bandage, named from the

resemblance in its folds to the arrangement of the leaves of an ear of corn, exercises a very exact compression around the point of the shoulder, and will thus depress the humeral extremity of the clavicle in cases of dislocation of that bone, provided the arm is also well supported. Care is requisite to protect the edges of the axilla, as otherwise they will be cut by the turns of the roller.

When the turns of this roller mount gradually from the point of the shoulder towards the neck, it is called a *Spica Ascendens*, but if its turns come from the neck to the shoulder, it becomes a *Spica Descendens*. Of course, it is optional with the surgeon to make either the one or the other, as it will depend on the point where the first turn is made after leaving the arm.

FIGURE OF 8 OF THE NECK AND AXILLA.

Composed of a roller, five yards long and two inches wide.

Application.—Place the initial extremity of the roller on the side of the neck, and fix it by one or two circulars of the neck, loosely applied; making them, for example, from behind forwards, and from left to right. Direct the roller as it comes

Fig. 55.

from the left side of the neck over and behind the right shoulder, confining any dressings that may be required either here or in the axilla; come up in front and over the shoulder, and then round the neck to the left side to follow the same course, covering only one-third of the preceding turns, and making a figure of 8, one turn of which shall embrace the neck, and the other the axilla.

Uses. — This bandage is very useful in retaining dressings before, behind, or above the shoulder, and also to the axilla or base of the neck, as it is easily made; and if not drawn too tight does not restrain the motions of the arm. It may also be made with a double-headed roller, the body of the bandage being applied under the axilla, and the heads crossed upon the shoulder of the opposite side, and then brought round the neck to cross on the injured shoulder and axilla of the same side. It is firmer, as thus applied, than the single-headed roller, but may press too much on the armpit, if care is not used in its application.

CROSSED OF ONE BREAST.

Composed of a roller, of eight yards by two and a half inches.

Position of the Surgeon in front and on the outside of the limbs of the patient, not in front of the knees, as this becomes awkward in the last turns of the bandage.

Application. — Fix the initial extremity behind the shoulder of the affected side, the right, for example. Carry the roller obliquely across the back over the opposite shoulder, and descend on the front of the chest to pass from before back-

wards and under the breast and axilla of the injured side. Fix by this turn the initial extremity of the roller, and go over the same course to form two or three obliques of the neck and axilla. On coming to the axilla of the diseased breast the third time, direct the roller transversely across the back to the axilla of the opposite or left side, and return by a horizontal turn in front of the chest to the point of departure to commence another oblique of the neck and axilla. Continue thus making obliques of the neck and horizontal turns of the body, each turn ascending and covering in one-third of the preceding one till the roller is exhausted.

Fig. 56.

Use. — This bandage is not only useful in retaining dressings to the breast, but also in supporting the breast itself, when requisite, as in cancer, lactation, &c., as it will very readily keep its place, unless picked at, for thirty-six hours. It may, however, be supplanted by the sling of the breast, as described hereafter, if it should be requisite to change the dressing twice or thrice a day, as this saves the fatigue of a reapplication.

CROSSED OF BOTH BREASTS.

Composed of a roller, ten or twelve yards long and two and a half inches wide, rolled either into one or two heads. If the patient is very fat, it may require a roller of fifteen yards.

Application. — Carry the initial extremity of the roller behind the right axilla, thence by crossing the back, direct the cylinder over the left

Fig. 57.

shoulder, pass obliquely across the front of the chest under the right breast, and under the right

axilla to the point of departure. Make thus two or three obliques of the neck and axilla, covering in the breast by the gradual ascent of each turn, and on reaching the back of the right axilla in the third turn, pass transversely across the back to the left axilla, under this and across the chest in front of the left breast to the right side of the neck, thence across the back to the same axilla, the left. Make thus two obliques of the neck and this axilla, and on coming to the front of this axilla pass transversely under both breasts to the right axilla, and under this to the point of departure. Care should be taken that each convolution cover successively the breasts from below upwards, without being drawn too tight. If the course here laid down be rigorously followed, we shall have an oblique of the neck and each axilla with horizontal turns before and behind, and the turns of the roller will mould themselves with great accuracy to the roundness of the breasts.

Use. — This is employed like the preceding one, to support or compress both breasts, and is exceedingly useful in patients who are annoyed by pendulous mammæ during lactation, &c.

The same bandage may be well made by means of a double-headed roller. In this case, place the body of the bandage in front of the sternum, and carry each cylinder under its respective axilla, to form an oblique of the neck and axilla, crossing on the back. After one or two obliques, carry one cylinder horizontally in front of, the other behind the chest, to make a half transverse turn, and then make other oblique and semi-transverse turns till the whole is covered.

APPARATUS OF M. RECAMIER, FOR THE TREATMENT OF CANCEROUS TUMOURS OF THE BREAST, AS MADE BY THESE CROSSED BANDAGES.

Composed of two single-headed rollers, two or two and a half inches wide and eight yards long;—disks of agaric,* varying from the size of a sixpence to that of a dollar.

Application. — Should the person be young, or one whose breasts are but slightly developed, a few horizontal turns of one of the above-mentioned rollers usually suffices, a disk or two of agaric, dependent on the number and the volume of the engorgements, being previously applied to the tumour, in order that the bandage may exercise a more perfect compression on the part. When, however, the mammæ are voluminous and soft, it is necessary to give them such a degree of solidity, that the engorged point may be prevented from escaping from beneath the compressing body; this is effected by the rollers being made to form the figure of S, or crossed bandage of both breasts; each of the branches will then tend to elevate the inferior part of one breast and depress the superior part of the other; a disk of agaric is now to be placed upon each of these organs, and confined by the turns of the roller; other disks are placed over this, diminishing in size, and interposed between each circumvolution of the bandage, until the cone has acquired a sufficient projection.

When the compression is only required to be effected upon one breast, the crossed of one breast is used.

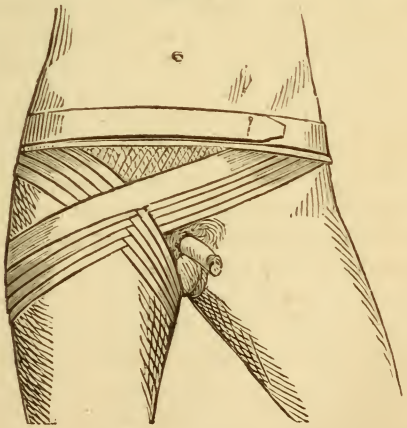
* Boletus Igniarius.

Observations. — The manner of applying this bandage must of course vary according to circumstances, but in every case the compression which is required to be exerted should be equal upon every point of the tumour, and moderately strong. The apparatus should be removed and reapplied once at least every twenty-four hours, in order that its action be constantly the same, — a thing of great importance as regards the result of the treatment.

SPICA OF THE GROIN, OR FIGURE OF 8 OF THE PELVIS AND THIGH.

Composed of a single-headed roller, eight yards long by three inches wide, and of compresses, if required.

Fig. 58.



Application. — Place the initial extremity above one of the iliac crests, and make two horizontal circular turns above the pelvis to fix it, turning

from right to left and from before backwards, if for the right groin, and the reverse if for the left. Arriving in front of one of the groins, say the right, place the compresses or other dressings in their position, and descend across them to the inside of the thigh between it and the genital organs, and winding round the back part of the thigh, ascend on its outside, to cross the first turn, thence to the iliac bone of the opposite side, across the back and round the pelvis, to follow the same course until the cylinder is nearly exhausted, when it should be fixed by a circular of the pelvis.

Use. — To retain dressings, or make compression on buboes, venereal ulcers, abscesses, &c., situated at the groin. If it is intended to make a Spica Ascendens, the first turn over the groin should go as far down the thigh as we wish to cover by the bandage, and each turn, covering in only one-third of that which preceded it, should gradually mount upwards. If, on the contrary, we wish to force matter from above downwards, the first turn should cross the groin high up near the abdomen, and by descending form a Spica Descendens.

This bandage of the groin is exceedingly useful after operations for hernia, or in other cases of hernia where compression is required and a truss cannot be borne or obtained.

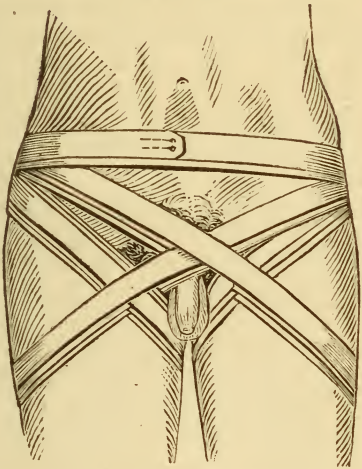
SPICA FOR BOTH GROINS.

Composed of a single-headed roller, ten yards long and two and a half inches wide.

Application. — Two horizontal turns are first made about the pelvis, going, for example, from right to left and from before backwards; upon arriving, at the second turn, near the left groin,

the head of the roller is made to pass obliquely downwards along the outer side of this thigh, and

Fig. 59.



ascend along its inner side to cross the first descending turn; it is next conducted round the back of the pelvis as far as the right groin, and passing hence along the inner side of this thigh, remounts on its outer side, and is carried again round the pelvis in front; the head of the roller is then made to pursue the track just described, until only a sufficient quantity remains to terminate the bandage by two more horizontal circulars of the pelvis.

Use. — Same as the former, but for both groins.

The spica of both groins may be very advantageously made with a double-headed roller. The body is applied to the front of the abdomen in a

line with the crests of the ilia, and each head carried around them, to cross behind the back and come round on each groin. Then let each one descend in the line of the groin between the genitals in the inside of each thigh, and pass under, behind and on the outside of them, to run, one to the right, the other to the left iliac crest, and thence round the back to follow the same course.

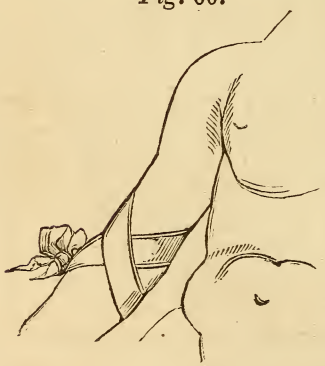
No bandage can be firmer or simpler than this, where it is requisite to make firm compression on each groin.

FIGURE OF 8 OF THE ELBOW.

Composed of a roller, two yards long and two or two and a half inches wide.

Application. — Place the initial extremity on the external and upper part of the forearm, and pass obliquely over the bend of the arm to the internal tuberosity of the humerus, round and above the olecranon to the external tuberosity, thence obliquely across the front, crossing the first turn in X to the inner and upper part of the forearm, and then across the back to the point of departure, to run the same course. If the arm is much flexed, make one circular over the point of the elbow after the formation of the second figure of 8.

Fig. 60.



Use. — This little bandage is very useful in covering in the elbow-joint, when the arm is either flexed or extended, and is therefore added to the Spiral of the Upper Extremity for this purpose. It is also much employed to retain the compress used after bleeding, as will be seen hereafter.

FIGURE OF 8 OF THE WRIST.

Composed of the same as the preceding.

Application. — Make one or two circulars around the wrist, either on its back or palmar face, to fix the end of the bandage, and on reaching the cubital side, run obliquely across to the space between the thumb and forefinger, say of the right hand, then obliquely over the palm to a corresponding point on the metacarpal bone of the little finger, hence obliquely across the back of the hand to the wrist-joint, whence make a semi-horizontal turn around the wrist to the ulnar side, to run the same course over again, as seen in the Spiral of the Upper Extremity.

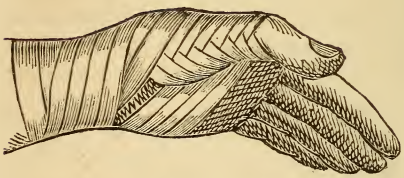
Use. — To cover in and compress the wrist-joint. This is also added to the Spica of the Upper Extremity in order to cover in this joint.

SPICA OF THE THUMB.

Composed of a roller, three yards long and a finger's breadth wide.

Application. — Fix the initial end upon the wrist by two or three circulars; after the last turn, which should be terminated upon its radial side,

Fig. 61.



direct the head of the roller from the external to the internal side of the thumb, pass between this and the index finger, to return and cross the base of the thumb and carry it onward again about the wrist: these double obliques are to be repeated, so as to form a spica, till the whole of the bandage is exhausted.

Use. — Principally in dislocation of the first metacarpal bone. It may be used also for the roots of either of the fingers.

FIGURE OF 8 OF BOTH THIGHS.

Composed of a few turns of a roller, two and a half inches wide.

Application. — Fix the end by one or two circulars of the middle of the right thigh, pass from the front of this to the back of and under the left, round its outside to the front, then over to the under part of the right, round it to the front, thence under the left thigh, and so on till three or four turns are made.

Use. — To keep the thighs together after the operation of lithotomy, or after the reduction of a dislocation of the femur.

FIGURE OF 8 OF THE KNEE.

Composed of a roller, two and a half inches wide.

Application. — Fix the initial extremity by one or two circulars below the knee, then pass obliquely over the patella, say from the outside to its inside; make a semi-horizontal turn on the back of the thigh above the joint to reach the external condyle, go thence obliquely over the patella to the inner side of the tibia, pass round behind it to the head of the fibula, and run the same course again till all is covered, as seen in the Spiral of the Lower Limbs.

Use. — To cover in the knee or compress the joint in various cases. This is added to the Spiral of the Lower Extremity, in order to cover in this joint. It is also used in fracture of the patella. If it is wished to retain a dressing to the popliteal space, we have only to reverse the turns of this bandage, that is, start it by circular turns from within outwards, and cross from below the knee behind to above it in front.

FIGURE OF 8 OF THE ANKLE AND INSTEP.

Composed of a roller, two and a half inches wide and the ordinary length.

Application. — If in the right foot, place the initial extremity above the external malleolus, and make two circular turns to fix it; then on coming to the external malleolus on the second turn, pass obliquely over the front of the instep to the tarso-metacarpal articulation of the big toe, thence under

Fig. 62.

the sole of the foot to the outside, horizontally over the instep to the same point, and then pass obliquely over to the external side of the os calcis, over this side of the bone, and round its point, up on its inside to cross the anterior extremity of the astragalus, over the upper part of the instep, down the outside at the point of the cuboid bone, under the sole to the inside of the calcis, around its point to the outside, and up over the instep to the point where the cuneiform internum is placed, and thence follow a similar course till the heel is covered in, which is generally done in two turns and a half of figures of 8. To cover in the extreme point of the sole of the heel, be careful that each turn that goes over the sole is kept as much backwards towards the point of the heel as possible, as the bandage will not slip off if drawn moderately tight. If it is not necessary to cover in the heel, the turns may be as in the figure.

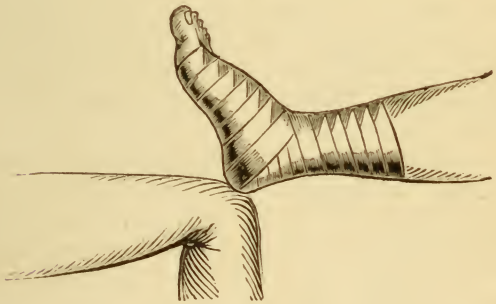
Use. — This bandage may be resorted to where we wish to retain dressings to the heel or instep, or front of the ankle-joint, as in the excoriations from the extending band of the apparatus for fracture of the thigh. It is also added to the Spiral of the Lower Extremity, where we wish to cover in the heel as well as the whole limb, as in the Compressing Bandage.

SPICA OF THE INSTEP.

Composed of a single-headed roller, seven yards long and *two inches* wide.

Application. — Lay the initial extremity of the roller on the tarsal end of the metacarpal bone of the little toe, if in the right foot, on that of the big toe, if in the left. Hence pass obliquely over the front of the foot to the first joint of the big toe in the right foot, or to that of the little toe if in the

Fig. 63.



other. Then go under the sole of the foot horizontally in a line with the metacarpo-phalangial articulation, to the outer or inner side of the foot, according as it is the right or left. From this point make two obliques over the front of the foot, which will bring us to the instep on its inner or outer side, and then pass directly to the point of the heel in a line parallel with the sole of the foot, the edge of the roller projecting a little beneath the sole, thence around the heel to come to the instep again, keeping still parallel with the sole of the foot,

cross the instep and make another turn similar to the first, which shall embrace the heel and instep, cover in one-third of the preceding turn, and form a spica on the instep. Continue these turns, gradually ascending, till the foot will hold no more, when we may terminate the bandage by circulars above the ankle, or else form a spiral up the limb.

Use. — This forms a most excellent bandage for cases requiring firm compression of the instep or ankle, as in wounds of the anterior or posterior tibial arteries at these points, and is at the same time exceedingly neat in its appearance: the figure also shows the proper position of the limb of the patient and of the surgeon. For it, as well as for many other practical details, I am indebted to M. Ribbail, of Paris, from whose excellent course on Minor Surgery, much that is of daily service has been gained.

The Figure of 8 of the Toes, or the Spica of the Big Toe, is so precisely similar to these bandages in the fingers and thumb as not to require a repetition. In applying any of them, make a few circulars of the instep instead of the wrist, and then proceed exactly as in the hand.

THE KNOTTED BANDAGES,

Named from their making a knot like that known as the Packer's Knot, are made of double-headed rollers, and are intended to make firm compression on particular points, as on bleeding vessels, &c. The only one of them of any importance, is that of the head, for arresting hemorrhage from the temporal artery, though under the same class might be included all those which are terminated by bows, as in the 8 of the elbow after bleed-

ing at the bend of the arm that of the ankle, as well as the Sailor's Knot, clove-hitch, and others employed in the treatment of Dislocations.

KNOTTED BANDAGE OF THE HEAD.

Composition. — A simple band, five yards long and two inches wide, rolled up into two heads of unequal size, one being a fourth larger than the other.

Application. — Place the body of the bandage over the graduated compress that covers the wounded artery, and conduct the two heads before and behind, to the opposite temple, where we reverse them in order to return to the point of departure; now give them a turn or twist, which enables us to carry one over the summit of the head, and the other underneath the chin, to the sound side, where they meet and reverse as in the first instance; from thence they are to be conducted in the same course, to the point of departure on the wounded vessel, and a second twist being effected, conduct them for the third time to the opposite temple, and for the third time also return horizontally and knot them firmly, each knot being behind the one first formed: being conducted finally, the one head over the

Fig. 64.

vertex, and the other underneath the chin, the bandage is terminated by a few circulars of the forehead and occiput.

Use.—For stopping hemorrhage of the temporal artery, or any of its branches; it is, however, a painful bandage, from the compression made on the lower jaw and point of injury, and requires attention, in order that it shall not remain on too long or be too tight. It is useful to close the opening in the vessel first, with a piece of adhesive plaster, as will be seen hereafter when treating of arteriotomy.

THE RECURRENT BANDAGES,

Are formed by convolutions or parabolic and recurrent turns, which make a kind of cap for the parts to which they are applied. Unlike most caps, however, they are exceedingly apt to become relaxed, and although very neat in their appearance, require more watching than is convenient, and are therefore often supplanted by other dressings. When required, they may be made either with the single or double-headed roller; but from the difficulty of removing the latter without its coming off in mass, and thus perhaps bringing ligatures, &c., altogether, that formed by the single-headed roller is the one most generally employed.

RECURRENT OF THE HEAD.

Composed of a single-headed roller, five yards long and two inches wide.

Application.—Place the initial extremity on one side of the head on a line with the supra-orbitary ridge, and carry the cylinder two or three

times round the head by circular turns. On coming to the middle of the forehead in the second turn, reverse the bandage and confine the reverse with

Fig. 65.

one hand while the cylinder is carried over the top of the head in the line of the sagittal suture, to the occipital protuberance; reverse here, and let an assistant fix the reverse; then come *obliquely* over the head to the forehead, make another reverse to go to the occiput, each turn covering in one-third of the preceding one, and continue thus till we reach the horizontal turn on the right or left side of the head, then cover in the opposite side by similar turns, each reverse being at the same point, in front and behind, and terminate the bandage by circular turns firmly applied.

Use. — To retain dressings to the head, as in the application of blisters to the scalp — in erysipelas, and other diseases of the scalp, &c. Care, however, must be taken not to draw the horizontal turns too tight, lest, as in the case related by Percy, ulceration or gangrene ensue.

RECURRENT OF THE HEAD OF TWO GLOBES.

Composed of a double-headed roller.

Application. — The body of the bandage is to be placed upon the occiput or forehead, and after two or three circular turns the rollers should intersect each other upon the occiput; one of them is then reflected over the vertex to the forehead, and the other continued in a circular course around the head. They next cross each other upon the forehead, when the first head is carried obliquely backwards to the occiput, and reflected by the side of the other. The last, *a*, is continued in a circular direction, but the first, *b*, is again brought over the head, from behind forwards, and carried in this way backwards and forwards in reverses till the head is entirely covered.

Fig. 66.

Use. — This, like the previous bandage, serves to confine dressings upon the head, but is rarely now employed for the reasons stated; the ancients exerted, by its means, compression on the heads of hydrocephalic patients.

RECURRENT OF AMPUTATIONS.

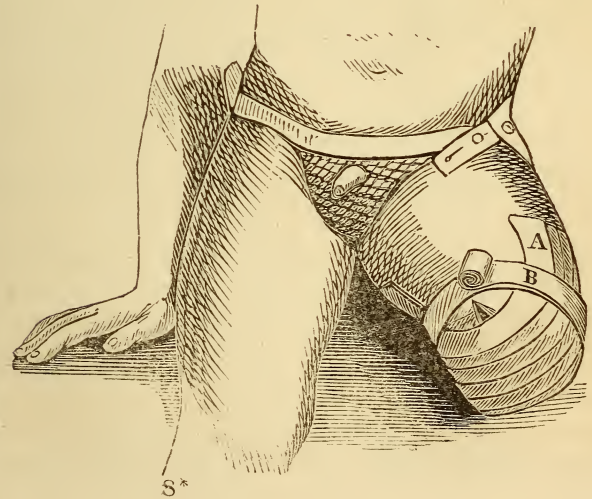
There are two varieties of this, according as it is made with a single or double-headed roller: as, however, it is difficult to remove the latter, I shall only give the application of the former, which is

Composed of a single-headed roller, of different lengths according to the volume of the stump to be covered, but generally two or two and a half inches wide.

Position of the patient, such as is most easy to him, with the stump well supported and the integuments pushed well over the end of the bone, by assistants. Then having arranged the Maltese Cross and other dressings —

Apply the initial end on the surface of the stump, about three or four inches above its extremity,

Fig. 67.



make two or three circulars to fix this, and on coming to the central point of the under portion of the stump — reverse, so as to run up in front of the stump and over its upper surface to a point, A, four inches above its extremity. Fix these reverses by the fingers of one hand, and continue to make them till the whole face of the stump is covered, when we terminate by spiral reversed turns, which, starting from the circumference of the stump, B, runs up a few inches above the first turn of the bandage, where it is to be confined by a pin. If there is a tendency to spasm of the stump, the ends may be carried on and fixed fast to the pillow or bed on which the limb lies, and will thus prevent its jumping. Care is requisite not to draw the recurrent turns at A too tight, as these, by compressing the soft parts against the point of the bone, cause irritation and spasm.

This figure also shows the application of a Suspensory Bandage, for the testicles.

SECTION SECOND.

OF THE COMPOSITION AND APPLICATION OF THE COMPOUND BANDAGE, OR THE BANDAGE PROPER.

It has been already stated that usage had justified the application of the term Bandage, to what should be strictly known only as the Roller, and that we should therefore designate what is the Bandage proper under the head of the Compound Roller or Bandage. These include a considerable number of our most useful means of retaining dressings, and their application is generally very

simple, though they are a little complicated in their composition. To the latter, therefore, we shall pay the most attention, hoping to render it so plain that any one may be enabled to make them properly.

THE T, OR CRUCIAL BANDAGE,

Named from its shape, is composed of *a horizontal portion*, of a length sufficient to go entirely round the part and leave enough to make a bow-knot, and of a *vertical piece*, which is half the length of the horizontal one and generally attached firmly to its middle, so as to form the perpendicular portion of the T. Each portion should be rolled into a cylinder, and confined by a pin previous to its application, in order to ensure its smoothness when applied. The vertical portion varies considerably in its shape and length, but these are exceptions to the general rule; sometimes it is three or four inches wide, and slit into two tails to within a short dis-

Fig. 68.

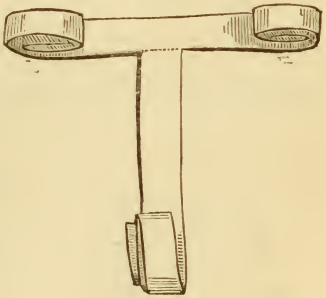
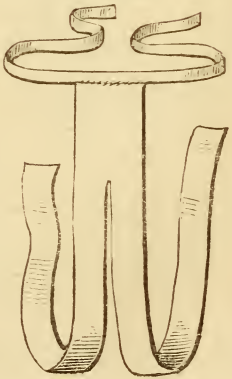


Fig. 69.



tance of the horizontal band, as in Figure 69; at others a triangular piece is added, &c., &c., as will be seen hereafter.

T BANDAGE OF THE HEAD.

Composed of a bandage, two yards long and two inches wide, upon which, at about one-third of its entire length, a bandelette half a yard long and of the same width, is stitched at right angles. The bandage is rolled up into two heads previously to its application.

Application.— Placing himself before the patient, the surgeon applies the body of the bandage to the middle of the forehead, the uppermost edge being that which corresponds to the vertical portion of the bandage, in order that the latter, after traversing the vertex, may hang loosely upon the nape of the neck; he now unrols the heads in passing them along the temples to the occipital region, where they cross the bandelette, which should be immediately reflected upwards, and secured upon the brow by a few turns of the double heads, or horizontal portion. A double T may be formed by simply stitching a second bandelette upon the transverse portion of this, at a convenient distance from the first.

Fig. 70.

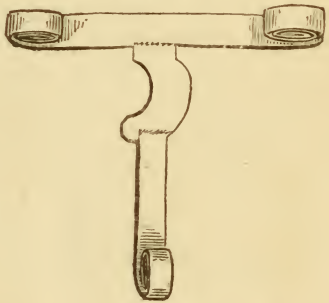
Use. — This is a retaining bandage; and should

be so placed that the vertical band may run over the point to be covered in. It is preferable to the recurrent bandage of the head, where the dressing is small, as it is not so heating. If likely to be deranged by slipping upwards, a band may be added, which shall pass under the jaw.

T BANDAGE OF THE EAR.

Composed of a horizontal band, two yards long, of a vertical one, a half yard in length, and of a piece of linen of the shape and size of the external ear. Sew the horizontal band to the summit of the ear-shaped piece of muslin, and attach the vertical one to the opposite part, or that corresponding with the soft part of the ear.

Fig. 71.



Application. — Fix the circular band over the ear of the affected side, and place the muslin over or close behind the ear; then carry the vertical band under the jaw and up on the opposite side, where it may be confined by the horizontal turns.

Use. — This modification of the T is an excellent bandage for retaining dressings to or behind the ear, especially the latter. Every one has felt the difficulty of retaining blisters or dressings to this part, but the construction of this little bandage removes it entirely. If made of black silk and narrow ribbons, it would hardly be noticed in

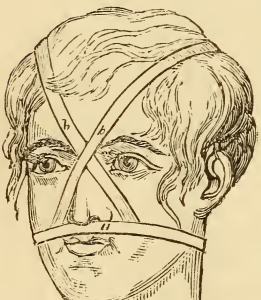
persons wearing whiskers, or in those wearing caps or bonnets.

DOUBLE T OF THE NOSE.

Composed of a band, one inch wide and two yards long, of two other bands of the same width, but one yard long. Sew these latter on the former, so that they may be one inch apart, and at right angles to the first band.

Apply the transverse band upon the upper lip, turning the border to which the vertical bands are sewed, upwards, then carry the two extremities over each cheek, and under the ears to the nape of the neck, where they are to be held by an assistant. Then cross the vertical bands upon the root of the nose, and carry each one over the parietal protuberance of its side, and down to near each mastoid process, under the horizontal band. Turn them over this to come upwards, and fix them by bringing the remains of the horizontal band from its crossing on the nape of the neck round the forehead, where it may be fastened either by a knot or a pin.

Fig. 72.



Uses. — This is an excellent bandage to retain dressings to the upper lip and root of the nose, especially to the latter in cases of fracture of its bones, or in epiphora or fistula lachrymalis, as it is easily renewed, and

does not interfere with the use of the eyes, nose, or mouth.

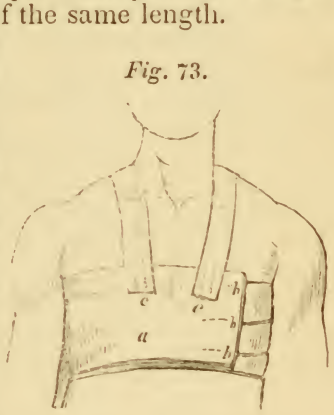
The single T bandage of the nose is a very useful one in retaining dressings to its surface, but as it is much improved by the addition of a suspensory, it will be treated of under those bandages.

DOUBLE T OF THE CHEST.

Composed of a napkin, or large compress of the same form, folded lengthwise in three; — and of a band two feet long, split nearly to the end, or of two distinct bands of the same length.

Application. — The napkin, *a*, is passed behind the shoulder-blades, and the two extremities brought forwards on the chest, upon which they are made to overlap; they are then pinned, and the unsplit extremity of the band, or the bands themselves being next fastened to the posterior part of the body-bandage, the tails are brought forward one over each shoulder, and secured in front, *c c*, to form shoulder-straps.

Fig. 73.



Use. — To confine dressings upon the chest; to furnish points for the attachment of other bandages, and in cases of fracture to compress the ribs.

DOUBLE T OF THE ABDOMEN.

Composed of a napkin, or a piece of linen of the same form, folded in three, to one of the borders which are stitched, at equal distances from its centre, two narrow bands half a yard long, to serve for thigh-straps; they should be attached sufficiently apart to correspond with the great trochanters.

Application. — The middle of the napkin is applied upon the loins, the extremities are brought round, on to the abdomen, upon which they are overlapped and pinned; the vertical bands are then conducted from behind forwards, crossed under the perineum, and fixed upon the forepart of the horizontal band.

Use. — To retain poultices or other dressings upon the abdomen, to exert compression on this part after the operation of paracentesis, or after delivery, and to furnish points for the attachment of parts of other apparatus.

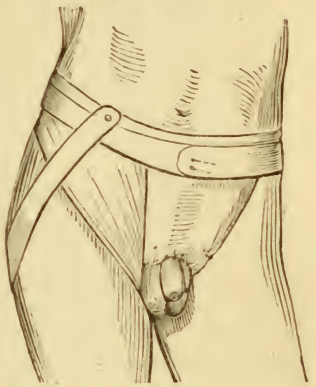
This, it will be seen, is the T of the chest reversed, the vertical bands being made to pass under the pelvis instead of over the shoulder.

TRIANGULAR, OR COMPOUND T OF THE GROIN.

Composed of a triangular piece of linen, four inches wide at its base and ten inches long, and of a triangular shape in order to correspond with the upper and internal part of the thigh; to the base of this is sewed a horizontal band, of about a yard and a half in length, and to its summit a vertical one three-quarters of a yard long.

Application. — The extremities of the horizontal band are carried round the pelvis on either side as far as the sacrum, whence they are returned and tied in a bow, above the pubes, while the vertical band, passing downward between the thigh and scrotum, comes up over the outside of the thigh, and is attached to the transverse portion of the bandage.

Fig. 74.

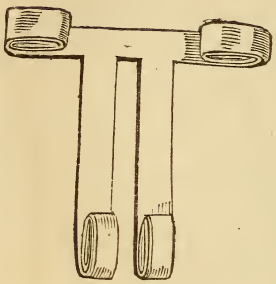


Use. — To retain dressings upon the groin of a patient confined in bed, as in poulticing of buboes, and after operating for hernia, &c. This is one of the best bandages that can be employed for retaining dressings to the groin, when it is requisite to renew them frequently, or where it is difficult to move or raise the patient, as with this it is only necessary to untie the vertical band and draw it from under the thigh, in order to lay open the whole groin to our view; and this may be readily done without the least movement on the part of the patient.

DOUBLE T BANDAGE OF THE PELVIS.

Composed of a roller, of sufficient length to pass twice or three times round the pelvis, and three

Fig. 75.



inches wide; — two vertical bands, each half a yard in length, and an inch in breadth, are to be stitched to the horizontal roller at right angles, and at about one-fourth of its entire length.

Application.—The transverse portion of the bandage is glided under the loins above the pelvis, so that the vertical bands may correspond to the median line of the posterior face of the pelvis; and its extremities being passed round the body, are fixed with pins; these bands are then brought under the perineum, crossed, and directed upwards and outwards to be fastened to the anterior part of the roller.

Use. — To maintain a dressing or surgical apparatus to the perineum, anus, or vagina, as in cases of piles, prolapsus ani, &c. Instead of the two tails, that formed by slitting the single T may be used, as seen in Fig. 69.

T BANDAGE OF THE HANDS.

Composed of a narrow bandage or piece of tape, one inch wide, half a yard long, and of a second piece one yard long. Sew the longest piece to the other to form the vertical portion of the T.

Application. — Place the horizontal band on the back or front of the wrist, so that the vertical band may present to the fingers. Carry this over the back or front of the hand, over the interdigital

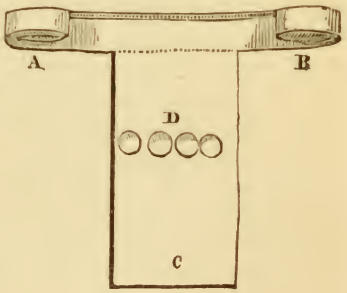
space of the first and second finger, come up again to the wrist, and surround the vertical band by a half turn of the horizontal one. Reverse the first over the latter to return to the space between the middle and third finger, retaining the dressing and coming up to the wrist again, surround it by the horizontal band, reverse the vertical one in order to pass between the ring and little finger, and on the outside of the latter to the wrist, where fasten it by the turn round the wrist.

Use. — This is a very light bandage for retaining dressings to the interdigital spaces as well as the body of the hand, and offers a substitute for the gauntlet or demi-gauntlet, as before seen.

T PERFORATED OF HAND.

Composed of a two inch roller, one yard long, and of a piece of muslin of the breadth and twice the length of the palm of the hand. Fold this on itself in its length, and cut in it four circular openings, D, about three lines apart, to correspond with the fingers, then sew one of its extremities at right angles to the roller or horizontal band, as in Fig. 76.

Fig. 76.



Application. — Pass the fingers through the openings, and stretch the muslin over the back and front of the hand, confining the loose end by

a few circular turns of the roller around and above the wrist.

Use. — Same as the above.

The T bandages of the feet are similar in their formation and application to the above.

INVAGINATED, OR SLIT AND TAIL BANDAGES.

These bandages might also be classed under the Uniting Bandages, as the general object of their application is to bring separated parts into contact. They consist of two kinds, one in which the same roller is formed at one end into strips or tails, and at another part, into slits or button-holes, and the second, in which two distinct bands are thus prepared, as seen further on. In either case, the tails of the one are passed through the openings in the other, and by acting on compresses, force all the parts under them to approximate. The first is employed to assist the union of longitudinal, the other of transverse wounds, as well as in the treatment of certain fractures. When wounds are deeply seated, the application of adhesive strips only unites the surface and leaves the parts below separated, so that, as the secretion of pus goes on, a bag or cyst is formed, from which it cannot escape except by burrowing underneath. When, also, divided parts have a tendency to contract, they very frequently tear out the stitches, and it is in both these cases that these bandages are exceedingly useful.

INVAGINATED FOR VERTICAL WOUNDS OF THE LIP.

Composed of a roller, two or three yards long

and one inch wide, rolled into two heads, and of two small compresses about two inches square, which are to be placed on the cheeks near the angle of the mouth.

Application. — Place the body of the roller on the forehead, or on the nape of the neck near the occiput, and carry each head round over the lower part of the ear, under the malar bones, and over the compresses to the lip. Then slit in one bandage a hole large enough to admit the other head; pass it through and draw upon each roller; carry them round to the neck, and then run the same course till the parts are well supported and covered in, as in Fig. 77, and terminate on the forehead.

Fig. 77.

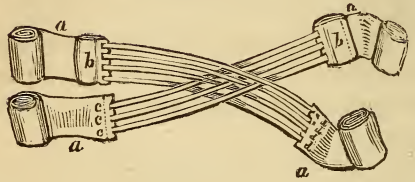
Use. — In vertical wounds of the lip, to support the harelip suture and prevent its cutting out. By the pressure which it makes on the lip, it is also useful in arresting hemorrhage from the coronary arteries.

M. THILLAYE'S BANDAGE FOR THE SAME.

Composition. — Four pieces of tape are required, each about two feet in length, and broad in pro-

portion to the depth of the lip, *a a a a;* to the extremities of two of these bands, which may be denominated posterior, are stitched two small linen pledgets or cushions, *b b*, about three-quarters of an inch square; while the two extremities of the others, or anterior tapes, are folded under, to have more solidity. Upon the extremity of one of these, are stitched three strips of extremely narrow riband, *c c c*, three inches and a half long, to connect it with one of the pledgets, to which also they are to be in like manner fastened, with a small space left on the free edges: four strips of riband, *d d d d*, similar to the first, are stitched to the extremity of the anterior tape of the opposite side, which, after being passed through the intervals of the first set, are fixed to the other pledget. By this disposition the bandelettes attached to either of the anterior tapes will be found attached to the pledget of the opposite side; the free extremities of the tapes are then rolled up and pinned. — Two small graduated compresses, eight lines long by six wide; — two pads large enough to occupy the space comprehended between the zygomatic arch on each side, and the inferior maxillary bone;—a single-headed roller of moderate size; — and two bandelettes, one a foot, and the other a foot and a half long.

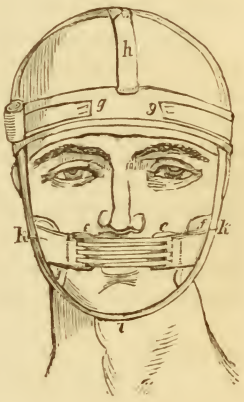
Fig. 78.



Application. — The single-headed roller is first of all passed horizontally round the patient's head,

to afford points for the fixing of certain parts of the apparatus; after which, an assistant applies at the distance of half an inch from the incised part, the graduated compresses, *e e*, which he retains in place while the surgeon applies the central portion of the quadruple-headed roller upon the lip; the latter then carries the heads of the posterior bands to which the pledgets are attached, in a horizontal direction, over the cushions, *f f*, placed between the zygomatic arch and the lower edge of the inferior maxillary bone, as far as the nape of the neck; from hence, after crossing each other in changing hands, they are made to ascend obliquely to the forehead, where the ends, *g g*, are pinned to the circular roller. Laying now hold of the anterior bands, we pull them in opposite directions, and bring, by the aid of the pledgets, the edges of the wound into contact; the heads of these two bands pursue the same course as those of the preceding, and the ends are fixed in like manner to the circles of the first roller.

Fig. 79.



The bandelettes serve to render the apparatus more secure; the first, *h*, passes along the sagittal suture, being attached before and behind to the circumvolutions of the roller; and the second, being applied by its middle, *i*, to the chin, passes upward to the temples, where it is fixed to the

same circular turns; a few stitches, *k k*, are inserted to connect it with the pads, and the whole is retained by the sling or four-tailed bandage of the chin.

INVAGINATED OF THE BODY.

Composed of a double-headed roller, of a length sufficient to go several times round the body, and of two compresses of the length of the wound.

Application. — Place the body of the bandage on the back, and bring the heads round under each axilla, and over the compresses on each side of the wound. Make a slit in the body of one side, and pass the cylinder of the other side through it, by which means the wound will be well closed. Continue this as often as may be necessary.

Use. — To unite longitudinal wounds of the chest or abdomen, or to support the parts after the removal of the breast.

INVAGINATED, OR UNITING BANDAGE FOR LONGITUDINAL WOUNDS OF THE EXTREMITY.

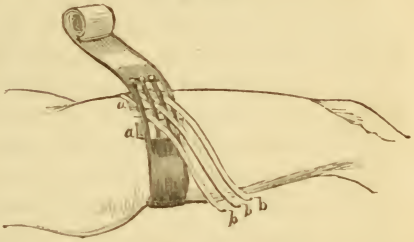
Composition. — One end of a piece of linen, of sufficient length to make three or four cir-

Fig. 80.

cumvolutions of the member, and of a breadth correspondent to the length of the wound, is divided so as to form three tails, about an inch broad, and long enough to embrace three-fourths of the circumference of the limb: at a convenient distance further on, are made three longitudinal perforations, opposite to, and of the same breadth as the tails. The remainder of the band is then rolled up; — two common graduated compresses also are required.

Application. — The undivided portion, situated between the tails and the perforations, being applied upon that part of the limb which is exactly opposite the wound, the graduated compresses, *a a*, are placed one on each side of the latter, at the distance of about three fingers' breadth from its edges; the tails, *b b b*, are then passed through the corresponding perforations, *c c c*, and the surgeon brings the edges of the wound in contact, by drawing the extremities of the band in contrary directions: the rest of the application consists in firmly securing the tails by some circulars made with the remainder of the bandage.

Fig. 81.



Observations. — This bandage may be used in longitudinal wounds of the upper as well as of the lower extremities. It may often be replaced, however, with advantage, by strips of adhesive plaster over the compresses, and over this a common dressing may be applied, and confined by a single-headed roller: the strips should be about a quarter of an inch apart where great closeness is required, otherwise they should be more distant; this is an extremely necessary precaution, as the confinement of blood, and still more of any extraneous matter, would be liable to occasion the formation of an abscess, that would speedily disunite the parts if prevented from escaping.

INVAGINATED OF TWO DISTINCT BANDS, OR UNITING BANDAGE FOR TRANSVERSE WOUNDS.

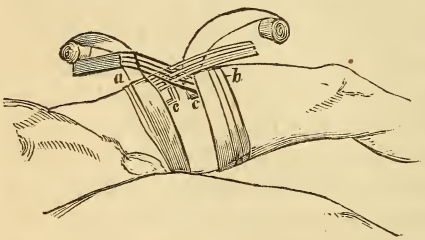
Composition. — A piece of muslin, or a roller of the same width as the wound, and as long as the member, is to be divided to nearly half its length into three tails or bandelettes; another and similar piece of cloth should be perforated in the middle with three corresponding longitudinal openings. The remainder of the objects consist of two common graduated compresses, and two single-headed rollers, one six and the other nine yards long, both three fingers' breadth wide.

Fig. 82.

Fig. 83.

Application. — The edges of the wound being brought together, the surgeon applies a spiral bandage to cover in the limb from its extremity up to the wound; that done, he extends the perforated band along the limb, so as to allow the upper extremity to pass a few inches beyond the wound, and the slits to lie upon the edge of the wound; he then fixes this by means of spiral turns carried round the limb, from below up to the edge of the wound, and reflecting what remains of it downward, se-

Fig. 84.



cures it by a few more turns. Confiding now the head of the roller to an assistant, he takes the tailed roller, and fixes its extremity above the wound by a few spiral turns, and carries it spirally up and down to the lower part of the thigh. Lastly, having applied the compresses, *c c*, one above, and the other below the wound, he engages the tails in the corresponding perforations, and draws the free extremities of the bands in contrary directions, in order to approximate the edges of the wound; when he considers them to be sufficiently in contact, he extends the bands along the limb, and while the assistants maintain them firmly fixed, confines them with what remains of the two rollers.

The cut shows this bandage applied to a transverse wound above the knee.

Observations. — This bandage may be replaced by the annexed, which, in point of fact, is a *dry suture.* Let two long strips of adhesive plaster (spread on strong linen) be procured, together with several bits of narrow tape. The parts being put into a complete state of relaxation, pass the straps about the limb, above and below the wound, at a convenient distance from its borders, as represented in the wood-cut; then passing through these two bands the bits of tape, tie their extremities together. But which ever of the two means just described be employed, it

Fig. 85.

will in general be necessary to give the divided parts greater support than either of them can effect alone: recourse must therefore be had, under such circumstances, in order to afford this additional support, to bandages calculated to ensure the approximation of the edges of the wound. Thus, in divisions of the flexor muscles, the limb must be kept bent; while, on the contrary, in cases where the extensors are concerned, the limb should be maintained upon the full stretch by the application of a splint made to pass along it, upon the side opposite the injury.

UNITING OF ONE SIDE, OR A BANDAGE FOR WRY-NECK.

Fig. 86.

Composition. — A single-headed roller, three

yards long and an inch and a half wide;—some soft compresses or a cushion to protect the axilla against the pressure of the roller; — and a napkin to surround the trunk.

Application. — The initial extremity, *a*, of the roller being directed toward the affected side, is placed upon the middle of the forehead and fixed by a few horizontal circulars; these should be secured with pins. The remainder, *b*, of the roller is then carried behind the shoulder opposed to the side affected, and under the axilla, where the cushion or padding ought to be previously placed, and thence to the forepart of the napkin, to which it should be firmly stitched; care being taken, however, to pull the head over with sufficient force to restore it to its natural position.

Use. — In cases of spasm or paralysis of the sterno-cleido-mastoidean and platysma-myoides muscles. It raises the head, brings round the face forward, and, when the affected parts have been operated on, opposes itself to the contractile efforts of the antagonist muscles.

PROFESSOR JÖRG'S APPARATUS FOR THE SAME.

This apparatus consists of a pair of leather stays and of a band or fillet for the head; on the centre of the forepart of the stays is a sort of pulley or groove, which can be turned round with a key in one direction, but becomes fixed in the other, through the means of a spring; a band passes obliquely upwards from the pulley to the fillet, to which it is attached behind the ear; when the band is drawn downwards by the pulley, it lowers

the mastoid process and approaches it to the ster-

Fig. 87.

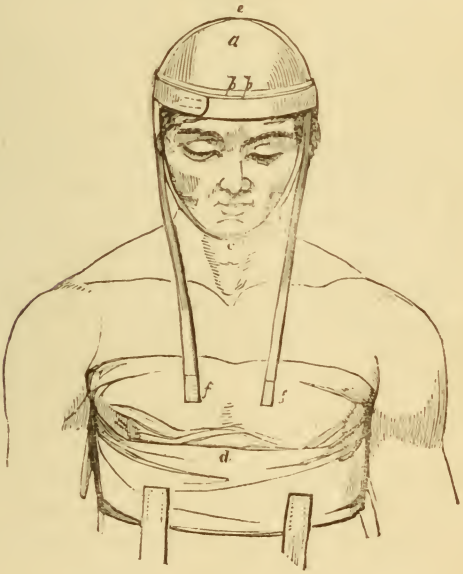
num ; it counteracts in this way the antagonisting muscles, and restores the head to its natural position.

UNITING BANDAGE FOR TRANSVERSE WOUNDS OF THE NECK.

Composition. — A single-headed roller, four

yards long ; — a band a foot long and three fingers' breadth wide ; — a body bandage with thigh-straps ; — and a compress a yard and a half long by eight inches wide, folded lengthwise in four.

Fig. 88.



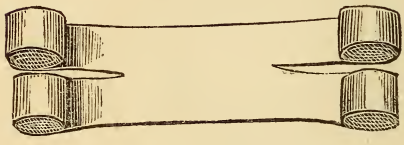
Application. — A night-cap, *a*, is fixed upon the patient's head by a few horizontal turns, *b b*, of the roller, which are made to fix at the same time the extremities of the band, *c*, placed by its centre upon the inferior part of the chin. The body bandage, *d*, is applied round the chest and pinned. The centre, *e*, of the compress being

lastly applied upon the upper and back part of the head, and secured by a few more horizontal turns of the roller, its pendent extremities are firmly fastened to the forepart of the body bandage, *f f*.

SLINGS.

These are light bandages of great simplicity, and very useful in retaining simple dressings, as they do not heat the part. They are formed of a piece of muslin of various lengths and width, split at each extremity into two or three tails up to within a few fingers' breadth of their centre, as seen in the figure. They are also occasionally formed of a piece of muslin of a size sufficient to cover the part, to each end of which are attached two bands to serve as tails, thus making it resemble the slings employed in war by the ancients for hurling stones, whence their name. In using the sling, the body or central part is first applied over the part, and the tails are carried round it and confined by knots or pins.

Fig. 89.



SLING OF SIX TAILS, OR THE BANDAGE OF GALEN.

Composed of a piece of linen, a yard long and a quarter of a yard wide, split at each end, to within three fingers' breadth of the centre, into three por-

tions, the central being somewhat broader than the others.

Application. — The surgeon placing the bandage upon the summit of the head, takes first the central tails, *a a a*, between the thumb and fingers of each hand, and passing them along the ears, secures them underneath the chin, *b*, observing, however, to fold the edges of each tail inwards so as to give it a triangular form, the base corresponding to the unsplit portion; the frontal tails are then to be directed from the anterior to the posterior part of the head, where they should overlap each other, while the occipital tails are brought forward and secured on the forehead by pins.

Fig. 90.

Use. — To retain large dressings to the head.

SLING, OR FOUR-TAILED BANDAGE OF THE HEAD.

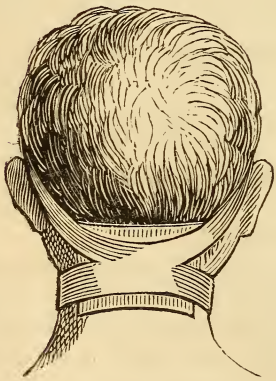
Composed of a strip of muslin, a yard long and six inches broad, split at each end to within three fingers' breadth of the centre.

Application. — When the wound is on the forehead, the body of the sling is applied there, and the two upper tails, carried posteriorly, are fixed at the back of the head; the lower tails are then fastened either upon the vertex or beneath the

chin, as the surgeon may consider it more convenient. To confine a dressing upon the summit of the head, the posterior tails, *a*, are brought down and secured beneath the chin; the anterior tails, *b b*, after being carried to the nape of the neck and crossed, are fixed before the throat, or brought again on the forehead (Fig. 91). In applying it to the nape of the neck, the upper tails are conducted over the forehead, from whence, after being made to cross each other, they are returned, and fastened at the occiput; the lower tails pass round the neck.

Fig. 91.

Fig. 92.



This latter forms the sling of the neck, as in Fig. 92.

Uses. — This bandage is a very simple and convenient one, and is of great utility in wounds of the head or neck, as it can be applied over every point of this part, by merely changing its direction. On the neck it

forms an excellent bandage for retaining blisters, setons, &c.

SLING OF THE CHIN.

Composed of a piece of muslin, six inches by four, slit at each extremity for two inches. To each tail attach a piece of tape or band one yard long.

Application. — Place the body of the sling under the jaw, so that the chin may be exactly in its centre, then carry the two posterior tails up over the cheeks to the mastoid process of each side, where an assistant holds them, turn the anterior part of the sling and the anterior tails upwards in front of the chin, and carry the tails under each ear to the nape of the neck, cross them to come forwards to the forehead where they may be knotted, after the tails from the mastoids have been carried under them.

Fig. 93.

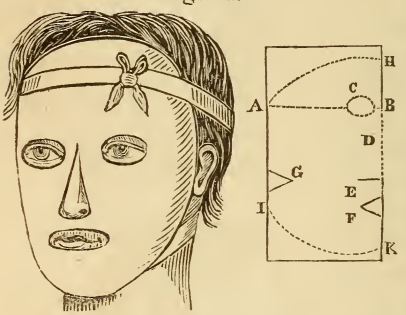
Uses. — In fracture of the jaw without displacement, and to retain dressings to the front of the chin or under the jaw.

SLING OF THE FACE, OR MASK.

Composed of a body piece to fit the face, and of four tails to hold it in its position.

Preparation. — Fold a piece of muslin, of nine or ten inches square, on itself, so as to form an oblong square. Place this on the face so that the double side may correspond with the central line of the face, and mark on it a line, A B, and a circular opening, C, for the eyes — make also a semicircular, F, for the mouth, and a small transverse cut, E, to correspond with the end of the nose. Cut off also the angles, A H, and I F, so as to give it an oval form, and cut out at G two triangular pieces, the edges of which are to be sewed together to adapt it to the projection of the cheek bones. Attach two vertical tails at G, and two horizontal ones at A ; then open it out and make a vertical cut, D, from the transverse one at the point of the nose up to the point between the two eyes, as in Fig. 94.

Fig. 94.



Apply this to the face and carry the upper tails to the occiput, cross them to come round on the forehead, and carry the horizontal tails to the neck to return also on the forehead or chin, as in the same figure.

Use. — To retain dressings to the whole face, as in cases of burns from blasting rocks, gunshot wounds, small-pox, &c.

SLING OF THE BREAST.

Composed of a square piece of muslin, sufficiently large to cover in the breast, slit for one inch and a half on each of its four sides, and of four bands large enough to go round the chest — these are to be sewed to its four angles.

Application — Whilst an assistant supports the breast or retains the dressing, place the body of the sling on it, and carry the lower tails under

Fig. 95.

each axilla to come round in front of the chest, and carry the upper tails on each side of the neck over the shoulder to be fastened to the horizontal band.

Use. — To retain a poultice or other dressing to

the breast, or to support it; but if compression is required, the *Crossed of the Breast* answers better.

The Four-tailed Sling may also be usefully employed in retaining dressings to the point of the shoulders, the elbow, back and front of wrist, to the heel and instep. In either of these cases place the point to be covered in the centre of the body of the sling and carry the tails round the part so as to fix it firmly.

PURSES OR SUSPENSORIES,

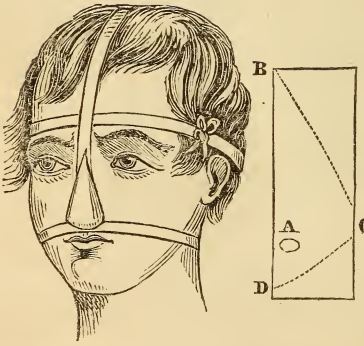
Are bags of certain sizes, which are intended to support depending parts, or retain dressings to them.

THE SUSPENSORY OF THE NOSE,

Is a neat mode of retaining dressings to the whole of this part, and is

Composed of a triangular piece, cut as in the dotted lines B C, and C D, of the figure, and to which are attached the vertical and horizontal bands of a single T.

Fig. 96.

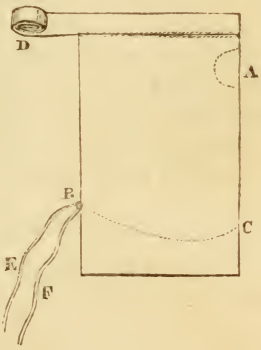


Application. — Place the nose within the suspensory, and carry the vertical band over the head to the neck, and confine it by the horizontal bands, which are to be crossed there and brought up on the forehead, and fastened as seen in the cut.

THE SUSPENSORY OR BAG-TRUSS OF THE SCROTUM,

As found in the shops, consists of a network bag and of bands to fasten it (Fig. 67); but as this cannot always be had, its place may be readily supplied by one formed as follows, the application of both being the same. Fold a piece of muslin, of a size to suit the part, say six inches by four, on itself, and cut out an opening, A, for the penis, and a curvilinear portion according to the dotted line B C. Sew the divided edges together, and attach a horizontal band, D, to the upper part, and two vertical ones, E F, to the lower posterior angle, making an opening or button-hole in the end of each band. Sew on two buttons on the horizontal band to serve for the attachment of the vertical or perineal bands.

Fig. 97.



Application.—The penis being engaged in the opening F, and the scrotum perfectly enveloped, the belt is carried round the pelvis, and being returned in front, is tied above the pubes; the two vertical bands are then made to ascend from the perineum along the inferior borders of the glutei muscles, to be buttoned to the belt in front.

Use.—To support and confine dressings upon the scrotum; to serve also for points of attachment to other apparatus, and for the treatment of swelled testicle, hydrocele, and irreducible scrotal hernia.

This bandage should be always worn during the treatment of acute gonorrhœa, as it diminishes the liability to epididymitis.

SHEATHS,

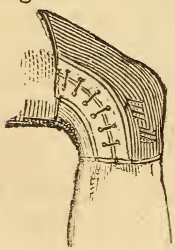
Are coverings intended to retain dressings to the penis, fingers, and toes. They are the finger-stalls of domestic use, and are employed daily by every one who has a cut finger; a very useful application of them can be made in cases of gonorrhœa; where, when made large, they will readily retain a portion of charpie to the head of the penis, and by absorbing the discharge prevent its staining the linen. They are also very useful in retaining poultices to the head of the penis, or dressings to chancres, &c., as they cannot be deranged by the erections. The band in these cases passes round the hips, as it does round the wrist when applied to the fingers.

LACED OR BUCKLED BANDAGES,

Are so named from the manner in which they are confined to the part: as they are usually obtained from the glovers and others, I shall only refer to them in passing.

LACED BANDAGE FOR THE KNEE.

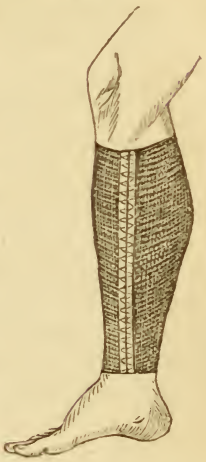
Fig. 98.



This is made of an elastic tissue, as buckskin or kid, which is lined with India-rubber, and laces at the side, as seen in the drawing. It is sometimes employed where constant compression is required, as after dislocations of the patella.

THE ELASTIC LACED STOCKING FOR VARICES,

Fig. 99.



Is employed for the compression of varicose veins, and also for the support of tender and extensive cicatrices of the leg, being occasionally preferable to the ordinary-rolled bandage, as it accommodates itself perfectly to the form of the limb, exerts an equal compression throughout its whole extent, is not liable to become deranged, and may be readily worn under a boot. Where it cannot be obtained ready made, slit a common strong cotton stocking down the side, and hem in on each edge a *very thin* slip of whalebone, and have a few eyelet-holes worked along the edges behind the bones, as in the corsets of the female. Like these, it is to be fastened by lacing it up with a braid.

LACED GAITER FOR THE FOOT.

Fig. 100.

This is constructed like the knee-cap, of buckskin or kid, and laces along the outside of the foot and ankle. It serves admirably for supporting the parts after sprains or weakness of the ligaments of the lower part of the leg and foot.

SECTION THIRD.

OF THE HANDKERCHIEF SYSTEM OF M. MAYOR, OR THE SYSTEM OF PROVISIONAL DRESSINGS.

Before taking up the consideration of particular fractures and dislocations, it will perhaps not be uninteresting to examine the new system of bandaging of Mr. Mayor, or the system which proposes and practices the employment of such simple means as are always at hand, or which may often supplant, with advantage, the means already mentioned, and supply their place whenever they cannot be obtained. The more readily we can procure these means, the greater also their simplicity and uniformity, the less embarrassing will it be for the surgeon to fulfil his duties, the less perilous will be the progress of the treatment, and the less doubtful the chances of its termination. These observations apply with particular force to the circumstances in which surgeons are often placed when practising among the poorer classes, in the country, in thinly-peopled districts, or in the army or navy, where the hospital stores may have failed or be rapidly diminishing. In doing this, Mr. Mayor has most successfully laboured, and made such a simplification of surgical apparatus, that under any — even the most disadvantageous circumstances, relief may be afforded, and a plan of cure employed as safe and as commodious as that used in the best appointed hospitals.

The principle he has laid down is, to use his own words, "Reduire, autant que possible, tous les appareils à leur plus simple expression, en les

rattachant à un principe unique et uniforme; et faire en sorte que les pièces de ces appareils, ou les objets matériels d'un pansement quelconque, soient si communs et de telle nature, qu'ils se trouvent dans toutes, ou presque toutes less circonstances, toujours à la disposition du chirurgien, et de tout le monde; et *qu'en l'absence* de l'homme de l'art, ils puissent être appliqués facilement par le *premier-venu*, après une très-legère instruction. En d' autres termes; trouver un moyen simple, facile à appliquer, sans cesse sous la main, ou qu'on puisse toujours se procurer, et qui soit propre de tenir lieu de charpie, de compresses, de remplissages, de bandes, bandages et liens, tels que la chirurgie les reclame pour toute espèce de pansement." —*Nouveau Système de Deligation Chirurgicale*, Paris, 1838.* Troisième edition, avec un Atlas.

This principle cannot be too highly appreciated, nor too generally adopted, and M. Mayor has eminently succeeded in carrying it out; although

* To reduce as much as possible all kinds of apparatus to their most simple principles, by making them dependent upon one particular and uniform idea; in order that the parts of such apparatus, or the material objects of any dressing, may be so common, and of such a nature as to be met with under every or nearly every circumstance, no less at the disposition, always of the surgeon, than of other persons; and that, *in the absence* of a scientific man, they may be applied with facility by the *first comer*, after very little instruction.

In other words, to find out a means, simple, easy of application, ever at hand, or at least always to be obtained, which may replace lint, compresses, bags, bands, bandages, and ligatures, such as surgery ordinarily requires for the various species of dressing.

for many years exposed to the sneers and ridicule of his professional brethren, and his plans of treatment are meeting everywhere with the respect they merit, and are daily becoming adopted, not only in very many parts of the Continent, but even in this country.

It would be impossible in a work of this description to consign all this celebrated surgeon's objections to the common modes of dressing and bandaging, or give the fullest details of his method of treatment: we will, however, condense the most interesting of his matter, believing that many valuable hints may be derived from it, even by those who would not feel inclined to abandon, altogether, the older and still more usual methods employed in the treatment of surgical accidents. In the meanwhile, it is recommended to those who are masters of the French language, to procure the original work.

It has not been M. Mayor's object, as he expressly says, "to banish wholly from the domain of surgery, charpie, lint, bands, &c., notwithstanding that such would be rigorously possible; but he has been so often struck with their abuse and their almost exclusive employment, that he could not forbear exposing their numerous inconveniences in practice, and endeavouring to establish his own motives for what he admits to be their *quasi-exclusion*."

The principal objection made by that gentleman, to the common bandages, is in relation to their frequent absence in the time of need, and the occasional impossibility of procuring them; then the serious inconveniences with which their

application may be attended when performed by unskilful hands; for it is an undisputed fact, that even under the best instructions the habit of applying them is slow in being acquired, and susceptible of being speedily lost. Bandages, too, are liable to become relaxed, easily deranged, and *corded*, thus inflicting injury in a variety of ways, and rendering their frequent re-application a matter of essential necessity: their diversity of length and breadth is also more or less perplexing to some; to roll them well, not a little troublesome; and when to these well-founded objections to their exclusive employment, is added the difficulty of having them always clean and neat, as well, also, as the little care that patients take of them when they are not absolutely wanted, it must be evident that some other means are requisite, to rid the surgeon of so many causes of vexation and embarrassment; and that, when such are found, they must be hailed by the profession with something like satisfaction.

As a bandage is acknowledged to be injurious which effects an unequal pressure, and becomes corded or otherwise deranged, it must appear quite evident that, were a certain degree of thickness afforded it, together with the greatest possible breadth, these effects would be readily obviated. Now, all the inconveniences here spoken of may be avoided, and all the good desired, obtained, from a bandage either of the original form of a cravat or pocket-handkerchief, or of the principal *deligatory* modifications of this, adapted to the nature of the case. M. Mayor makes four modifications of a handkerchief or cravat-shaped piece

of linen, subservient to all the objects of a bandage. These are, the *oblong*, the *cravat-shaped*, the *triangular*, and *cordiform ;* the latter is only employed as a substitute for a cord, or strong tie, in certain apparatus, and is obtained by twisting a cravat.

None of the objections made to the ordinary bandage can be applied to this. It is found everywhere, and under every circumstance ; is easily adapted to its purpose ; is not liable to become relaxed or otherwise deranged, and cannot become corded ; is easy to fasten ; may be changed and reapplied with the utmost promptitude, as a single circumvolution of it is often equal to a multitude of turns of the common band ; is also more economical, as it may always be washed, and made ready to apply to other than surgical purposes ; the thickness and breadth can be varied at will : in short, it is so much the more perfect as it forms one whole, while each turn of a common band, being considered as a piece apart, the derangement of one necessarily entails the derangement of all the rest.

It is not pretended by M. Mayor, let it be again observed, that this new description of bandages can supply, *completely*, the place of common surgical bands ; for, as he justly observes, there are cases which require a methodic compression of a certain energy, more particularly some affections of the breasts and of the extremities ; but these are comparatively rare ; and exception being made of such, the new description, as being the most valuable, should be employed *in common*, while bands should form but the *exception* to this general rule.

With regard to the advantages derivable from the substitution of soft rag for charpie, in the view of economy, little need be said, as the latter article is in this country so rarely used; still, the common objections to the employment of charpie will in many instances be found equally applicable as regards lint, and more particularly in this, that lint, like charpie, cannot be washed; like it, too, it often becomes musty when kept for some time; and, consequently, its application to wounds would thus be rendered highly injurious.

What is the end proposed in the application of lint or charpie to the surfaces of wounds? Is there in either one or the other any intrinsic medical virtue? or are they simply placed there, to serve for protection, while nature and constitutional remedies are actively engaged in operating the cure? Why may they not be replaced by old linen, which is not only as soft and as free from stimulation, but, if judiciously selected, quite as penetrable? Pieces of old linen are applied as easily as lint, more easily than charpie, and may be lifted off with greater facility than either, causing the patient by no means as much pain.

In short, linen rag possesses striking advantages, not only in the cases wherein water and mucilages are used as a remedial agent, or rather as an auxiliary of nature, but even in those in which cerates and ointments are employed.

In some particular surgical diseases, the affected surfaces require a sort of bedding of a very soft and supple character, and to fulfil this indication something is exacted of the nature of lint or charpie: this species of material is necessary also for the construction of *tentes*, &c., in sinuses and

fistulous openings. Now, instead of lint or charpie in such cases, M. Mayor strongly recommends the use of *Carded Cotton.* This substance is much more abundant, much more easily obtained, lighter, somewhat easier of application, and adheres so much better, that it rarely requires the superaddition of a retaining bandage. With respect, however, to the latter quality, this might in certain circumstances be considered an objectionable one; but in point of fact, where, in the removal of the cotton, the nascent cicatrix might be endangered from the attempt at tearing it suddenly away, every possibility of accident may be obviated by moistening it well with warm water, when it will be found to detach itself with the utmost facility and in mass.

It may, perhaps, be sometimes advisable to apply round the edges of the wound a *protective bandelette,* or strip of spread cerate, or, where the wound is not very extensive, to cover the whole application with a piece of adhesive plaster: so that when the cerate is taken off, the whole mass may follow without any dragging.

In its use, however, to suppurating sores, we should always recollect the caution given in regard to it under the head of dressings, viz., to see that it is free from the eggs of the fly, as they, by being hatched, will invariably generate maggots.

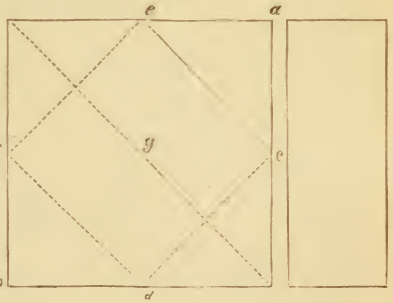
In the application of the handkerchief, or triangular piece of linen, to cases to which it may be adapted, M. Mayor commences at the head, and then, as in our own arrangement, proceeds regularly to the trunk and extremities, and in pursuing this course, he designates his handkerchief bandages by certain names, which may at first sight

appear to be unnecessary and pedantic; but when it is recollected that the arrangement of the name shows the course to be pursued in the application of the handkerchief, it will be seen that it is of considerable importance, and that it aids us materially in their application; thus, in the *fronto-occipital triangle*, we have the shape of the handkerchief, and the statement of the fact that, it is to be first applied to the forehead and then to pass to the occiput; so in the *fronto-cervico-labialis*, or the *occipito-sternal*, we know that it should cover, first the forehead, then the neck, then the lip; whilst the other starts from the occiput and ends at the sternum.

THE HANDKERCHIEF, OR SQUARE LINEN.

The HANDKERCHIEF, OR SQUARE LINEN, may, by itself, replace all the bandages that we have before treated of, and in its dimensions, as well as in the tissue composing it, must be regulated by the size of the part to which it is to be applied, or the circumstances of the moment. It is, therefore, a matter of indifference, whether it be of silk, cotton, or linen; and if too short to go round a part at the time of its application, may be easily lengthened by attaching to its extremities two pieces of tape or ribbon.

Fig. 101.



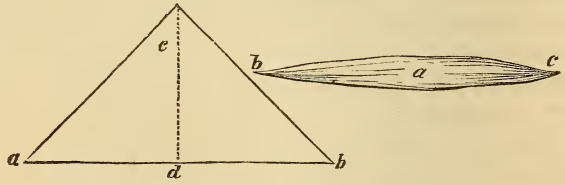
From this original piece we may form all the

others by folding it according to the dotted lines of the Fig. 101; thus, if the four angles are folded into the centre, *g*, we shall have a smaller square, which may be again reduced by repeating the process. In this shape it answers very well for the application of warm, fomenting poultices, which may be thus easily retained between the two layers of the handkerchief. If the square handkerchief is folded from angle to angle, we shall have the

TRIANGLE.

This triangle varies in size according to the part to be covered in by it; though the largest of those employed at Lausane was about a yard in length, and a half yard from its summit to the centre of its base. When we wish to have a smaller triangle, divide this according to the line, *c d*, or cut off portions on each side. Thus formed, the parts of the triangle, are the base, *a b*, the angles or extremities, or points of these same letters, and the summit, *c*. In order to apply it, hold it smoothly

Fig. 102.



by the base, placing the thumbs above or on its upper surface, and the fingers, widely extended on its under surface; then apply the base first, and carry the extremities around the part so as to cover in the summit, making folds or plaits of any portion of it that may project.

The Long Square, as in Fig. 101, does not require much explanation, as it is readily seen to be formed of the common square doubled once on itself.

The Cravat, as in Fig. 102, is so well known, as also to require no explanation, the shape being that which we daily employ in arranging the covering to our necks. Like the triangle, the body, or base *a*, is the part first applied, and this is retained in its position by attaching its ends, *b c*, to other parts of the body.

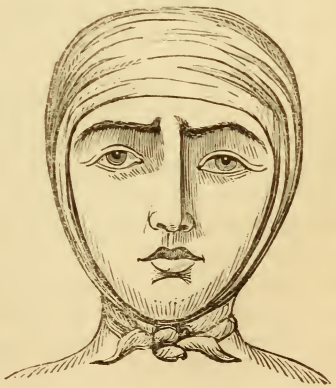
The Cord is made by twisting the cravat on itself, and is of great utility in compressing vessels, as a substitute for the tourniquet.

The first application of the handkerchief is to cover in the whole head, and is called

THE SQUARE CAP OF THE HEAD.

Form the handkerchief into an oblong square, and let the edge of the side to go next the head be two inches shorter than the other. Draw the ends of the long side down the side of the face, and tie them under the chin, then draw the inner ends, or those of the short side forwards,

Fig. 103.



to free them from the former, and folding this part backwards, tie the ends on the occiput.

Use. — To cover in the head, ears, and jaw.

FRONTO-OCCIPITAL TRIANGLE.

Application. — The base is placed before the forehead, higher or lower, according to circum-

Fig. 104.

stances ; and the lateral angles or *tails* are crossed at the occiput, from whence they are to be brought forward as far as the temporal regions, or on to the forehead, where they are to be fixed by means of pins. Fig. 104.

The summit is then conducted and fixed at the occipital region, by being made to pass under the posterior portion, from whence it is reflected upwards and pinned. Fig. 105.

Fig. 105.

Use. — To retain dressings to the head.

OCCIPITO-FRONTAL TRIANGLE.

Application. — Base at the occiput; tails crossed upon the forehead. Summit passed underneath the frontal portion and reflected upwards.

Use. — Same as the former, but more useful when a little pressure may be required on the forehead. This is made by the crossing of the angles, or the knotting of them.

BI-TEMPORAL TRIANGLE.

Application. — Base upon one of the temples; summit turned over towards the opposite ear and confined by the angles carried around the head.

Use. — To retain dressings to the temples.

SIMPLE OCULO-OCCIPITAL TRIANGLE.

Application. — Base stretched obliquely from

the superior part of the temporal region of the sound side over one eye to the submastoid region of diseased side; summit carried diagonally backwards to the posterior portion, where it crosses at the side of the neck corresponding to the sound eye.

Use. — To cover in one eye.

FRONTO-OCCIPITO-LABIALIS CRAVAT.

Application. — Body against the forehead; tails first crossed at the nape of the neck, then brought forwards to either lip, where one is passed through a slit perforated near the extremity of the other; these extremities are then pulled in contrary directions, over the compresses on each side of the wound, and secured by a couple of small pins or a few stitches under the ears. If a triangle is used, the summit is carried to the occiput, passed under the first intercrossing, reflected upwards and pinned.

Fig. 106.

Use. — To sustain the union, in wounds of the lip, or after the hare-lip operation; to confine the dressings, or to unite wounds in the absence of other means.

FACIAL TRIANGLE, OR MASK.

Application.—Place the base under the chin, the summit on the forehead, and carry the angles over the ears to the vertex, where they may be crossed and brought on the forehead to confine the summit; holes or slits are then to be made for the eyes, nose, and mouth.

Fig. 107.

Use. — To retain dressings to the face.

VERTICO-MENTAL CRAVAT.

Application.—The body of a broad cravat is placed on the vertex, and the ends are carried under the chin, and fastened to the sides of the first turn, by the ears.

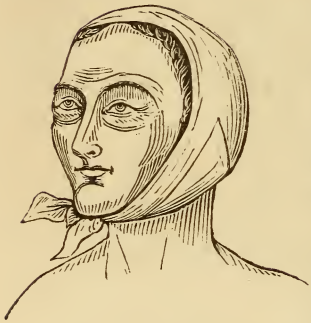
Fig. 108.

Use. — To retain dressings under the chin or base of the jaw.

OCCIPITO-AURICULAR TRIANGLE.

Application. — Base obliquely in front of the injured ear, summit carried round towards the same

Fig. 109.



ear, one angle carried under the jaw on the side affected, to come up in front of the opposite ear, where it makes a knot which ties under the ear, or a turn around the other angle, so that the two may run round the head, the one in front, the other behind, to tie on the side.

Use. — To retain dressings to one ear, or to the angle of the jaw, without interfering with the opposite ear.

OCCIPITO-STERNAL HANDKERCHIEF.

Application. — Two handkerchiefs, one in cravat, the other in triangle. Place the base of the tri-

Fig. 110.

angle at the occiput, with the summit anteriorly; the tails are then to be brought down along the sides of the head and face, and fastened to the front of a *sterno-dorsal* or *dorso-thoracic cravat.*

Use. — To unite wounds of the throat, and bring the head to the chest.

FRONTO-DORSAL.

Application.—Reverse of the above. Base of the triangle upon the forehead; summit carried posteriorly; tails turned downwards and backwards, to be fastened to the back of a *dorso-thoracic cravat.*

Fig. 111.

Use. — Reverse of the former, or for wounds of the back of the neck.

PARIETO-AXILLARIS.

Application. — Base of the triangular handkerchief on one side of the head, summit carried to the

opposite side, and the ends tied to an axillo-acromial cravat.

Fig. 112.

Use. — To bring the head to one side, as in wry-neck, spasm of sterno-cleido muscle, &c.

CERVICAL CRAVAT (OF DAILY USE).

Application. — Centre before the larynx, the side of the neck, or against the cervical vertebræ, according to circumstances; constituting an *anterior lateral*, or *posterior-cervical.*

Use. — As a retaining bandage for dressings applied to the neck.

SIMPLE BIS-AXILLARY CRAVAT.

Application. — Place the centre at the axilla of the affected side, cross the tails over the corresponding shoulder, and then carry them one before, the other behind, the chest, to the axilla of the opposite side, where they are to be secured.

Use. — To retain dressings to the axilla.

Fig. 113.

COMPOUND BIS-AXILLARY CRAVAT.

Fig. 114.

Application. — Place the centre of a cravat at

the axilla of the sound side, carry the tails obliquely upwards to the base of the neck at the opposite side, and fasten their extremities; next, apply the centre of a second, and smaller cravat, at the axilla of the affected side, and attach its tails to the corresponding portion of the first.

Use. — Same, but to both axillæ.

SIMPLE BIS-AXILLO-SCAPULARY CRAVAT, OR POSTERIOR 8 OF THE SHOULDER.

Fig. 115.

Application. — Place the centre between the scapulæ, carry one of the tails round the corresponding shoulder and axilla, and fasten the extremity by strong stitches to the body of the cravat; in the next place, conduct the other tail under the corresponding axilla, and over the shoulder, toward the extremity of the first, upon which it should be similarly secured.

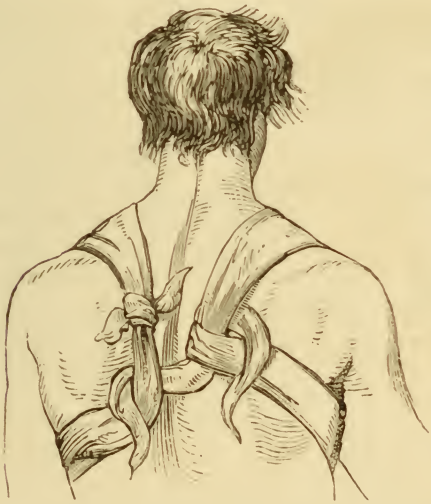
Use. — Same as the foregoing.

COMPOUND BIS-AXILLO-SCAPULARY CRAVAT.

Application. — Knot together the two extremi-

ties of a cravat about one of the shoulders, so as to make of it a loose ring: next, take a second cravat; apply the centre of this against the anterior face of the other shoulder, and conducting the tails one over the shoulder and the other beneath

Fig. 116.



the axilla, let the first embrace the corresponding portion of the ring, in order that its extremity may be united with that of the second tail, which should be made previously to pass about the first, in the manner represented in the wood-cut.

Use. — Same as the two preceding, but prefer-

able to either, on account of the much greater power it may be made to exert.

DORSO BIS-AXILLARIS.

Fig. 117.

Application. — Place one handkerchief in a cravat round the chest under each axilla, and the other in a triangle on the back, with its base upwards. Fix the summit of the triangle to the circular cravat, and carry the angles over each shoulder and axilla to fasten to the circular handkerchief behind, and on the sides.

Use. — To retain dressings to these parts. If the summit is fixed to the circular cravat in front, and the angles brought over each shoulder to fasten behind, it will retain dressings to the front of the chest, and form a *cervico-thoracic handkerchief.*

TRIANGULAR CAP OF THE BREAST.

Application.—Base of a triangle obliquely across the chest under one breast — summit over corresponding shoulder, one angle over opposite shoul-

der, the other under corresponding axilla, to tie on the back and confine the summit.

Fig. 118.

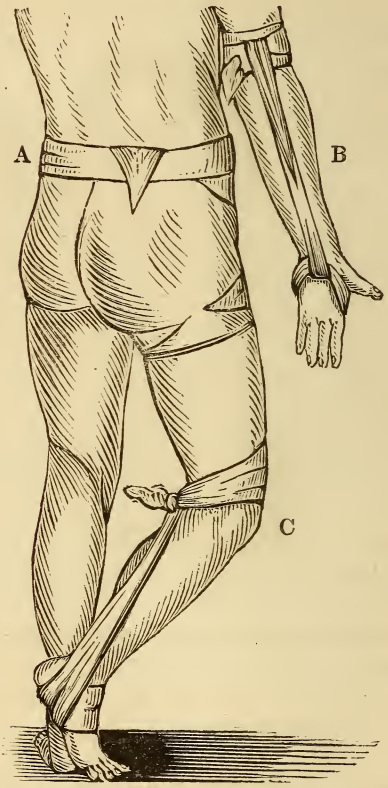
Use. — To retain a dressing to, or support, the breast.

SUB-FEMORAL HANDKERCHIEF.

Application.—One handkerchief in a cravat goes circularly around the pelvis. The base of another, which is in a triangle, is applied obliquely on the thigh, the angles passing circularly around its

upper part, and the summit obliquely up between the nates, to be fixed to the circular band, as at A.

Fig. 119.



Use. — An excellent bandage to cover in the pelvic portion of the body, and the only one that does it with great neatness and accuracy.

INTER-FEMORAL.

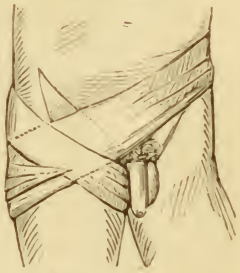
Application.—Base on the back—angles brought round the pelvis — summit over the perineum, to fasten in to the angles in front, as in the diaper of children.

SINGLE SPICA.

Application. — Place the body of a cravat in the line of the groin and carry one extremity around the pelvis, the other around and below the thigh to meet it on the groin. If not long enough, attach tapes to the extremities.

Use. — To retain a dressing to one groin.

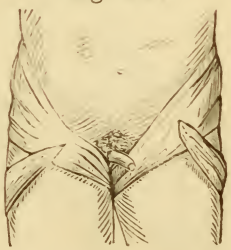
Fig. 120.



DOUBLE SPICA.

Application. — Fold two handkerchiefs in cravats, and tie an extremity of each together. Place the knot a little on one side of the spine, and carry the other extremity of each, round over each innominatum in the line of the groin, between the thighs, and round their outside, to come up and fasten on to the bodies of the cravats.

Fig. 121.

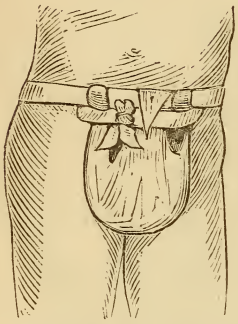


Use. — To retain dressings to both groins.

SUSPENSORY OR SCROTO-LUMBAR TRIANGLE.

Application. — Form a lombo-abdominal cravat for a belt, and apply the base of a triangle to the under and back part of the scrotum; carry the tails up alongside of this to the forepart of the belt, about which, pass them from before backward, as represented in the wood-cut, and tie the extremities, so as to bring the knot in front, and prevent its chafing. Next carry the summit upwards, pass it under the transverse portion of the tails and under the belt, reflecting it over the forepart of the apparatus, so as to secure it with a pin.

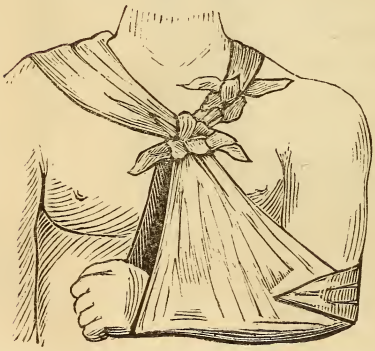
Fig. 122.



Use. — To support the testicles.

CERVICO-BRACHIAL SLING.

Fig. 123.



Application. — Place one handkerchief in a cravat around the neck, and knot its ends over the sternum. Place the other in a triangle under the forearm, so that its base may be next the wrist, then tie its angles to the cravat, and

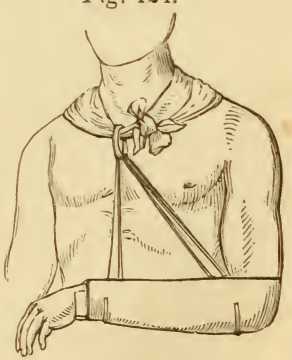
carry the summit around the elbow to fasten to the body of the triangle in front.

Use. — To support the forearm. This method of forming the sling is better than the common way, as the knots do not cut the back of the neck, owing to the position of the cravat, whilst the summit, being fixed at the elbow, keeps the arm more closely to the side of the body.

ANTE-BRACHIAL TROUGH.

Composition. — The trough may be either constructed of leather or pasteboard, which latter may be covered with some appropriate material with the view of preserving its form, and even giving it a sort of embellishment; and may be either straight, that is to say, open at the level of the elbow, or, as represented in the wood-cut, terminating there in a cul-de-sac: — a long riband or cord is required to serve for its suspension, and constitute two collateral bows, to which the author applies the term of *arc-loops*;—lastly, a cravat.

Fig. 124.



Application. — The cravat is arranged so as to constitute a CERVICAL CRAVAT. Four holes being previously bored through the trough, at convenient distances apart, near its borders, the cord is then run through in order to form the *arc-loops*, which, in their passage, should be made either to glide through the Cervical Cravat,

or, what is better, through a ring, as represented in the wood-cut, which serves to connect them, and allows of a free play of the loops, from which the patient will derive no small convenience. When the apparatus is thus prepared, nothing remains to be done but to introduce therein the patient's forearm, which has been, if fractured, previously furnished with its bandage.

Observations. — This apparatus may be worn enclosed in the patient's ordinary dress, so as not to give the appearance of the arm being subjected to confinement. If, however, it be required to preserve the elbow fixed against the trunk, a riband may be made to pass through a couple of holes perforated in the internal portion of the trough, or that which corresponds to the body, and to embrace the trunk as a belt or body-bandage. If it be necessary to give support to the hand or wrist, a thin, flat piece of wood may be laid at the bottom of the trough, and its projection beyond the end of the latter regulated by circumstances.

TRIANGULAR CAP OF THE SHOULDER.

Fig. 125.

Application.—Base of the triangle at the insertion of the deltoid muscle, or elbow, the summit over the acromion, and the angles carried round the arm, and tied on it as in the figure.

Use. — To retain dressings to the round part of the shoulder or body of the arm.

TRIANGULAR CAP: — FOR THE HUMERUS AND ALL OTHER AMPUTATIONS.

Application. — The base of a triangle is to be conveniently placed under the limb, and at a convenient distance from the extremity of the stump; the tails are then to be brought forward and overlapped, and the summit to be carried over the stump and fastened to the circular portion of the angles. In this last part of the process care should be taken that the linen embrace in the most perfect manner the extremity of the stump, as shown under the head of dressings.

Or, instead of commencing with the lateral angles, the summit may be first carried upwards in the manner described, and then the tails, in encircling the limb, may be made to include its extremity.

Observations. — Whether employed in amputations of the upper or lower limbs, of the fingers or toes, or even of the penis, nothing can be more simple or more effectual than this bandage. In general, no further precaution is necessary than to insist upon the patient remaining quiet; for if the apparatus be carefully applied, there will be hardly a possibility of any derangement. But should it be absolutely necessary to have recourse to some expedient to prevent the apparatus from becoming detached, a cravat belt may be applied about the neck, or pelvis, the lower part of the arm, or thigh, the wrist, or ankle, according to the seat of the operation, and the limb may then be fastened to this by bands or tapes.

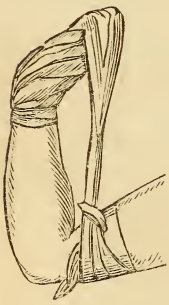
CARPO-OLECRANIEN.

Application. — Fold two handkerchiefs into cravats, and apply one circularly around the arm above the elbow. Then tie one extremity of the other around the articulation of the carpal and metacarpal bones, so that the knot may come on the back of the hand, and attach the other extremity to the circular cravat, as in the arm of Fig. 119. (B.)

Use. — To keep the forearm extended. When a splint is passed under each handkerchief on the front of the arm, it answers very well in the treatment of the latter stages of fracture of the olecranon.

FLEXOR OF THE WRIST.

Fig. 126.



Application. — Place a cravat circularly round the arm above the elbow, and a triangle around the hand so that the summit may be folded round it, and fastened by one angle around the wrist. Flex the hand and forearm, and attach the other angle to the cravat on the front of the arm.

CARPO-DORSAL, OR PALMAR TRIANGLE.

Application. — Place the base of a triangle on the dorsal or palmar surface of the wrist, and carry the angles round this and the summit over the fingers, which are to be flexed, as in Fig. 127, if a dorsal handkerchief is wished. If not, slit holes in

the handkerchief, as in the perforated T of the hands, and passing the fingers through them, attach the summits to the angles.

Fig. 127.

Use. — To retain dressings to the back or front of the hand, or between the fingers.

METATARSO MALLEOLAR CRAVAT.

Application. — Place the body of the cravat obliquely across the instep, and carry one extremity round above the malleoli, the other round the sole of the foot and instep, to join it on the front of the ankle.

Fig. 128.

Use. — To retain dressings to this part, as after tying the anterior tibial. Where pressure is required, the spica of the instep should be substituted.

TRIANGULAR CAP OF THE HEEL.

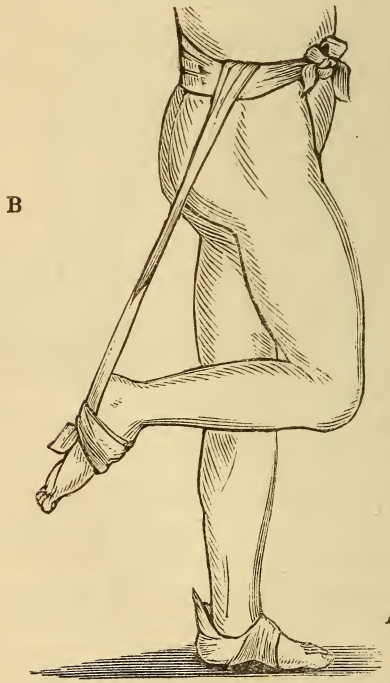
Application.—Base to the sole of the foot directly under the instep, summit over one malleolus, angles crossed on instep, and then carried around the malleoli to confine the summit, as in the foot of Fig. 129. (A.)

Use.—To retain dressings to the heel. This is an excellent bandage in the treatment of the excoriations often consequent on the use of the extending band in the treatment of fractures of the thigh.

TARSO-PELVIEN CRAVAT.

Application. — One circular cravat around the pelvis, the body of a second on the top of the foot, with one end tied under the sole, the other fastened to the pelvic band, as at B.

Fig. 129.



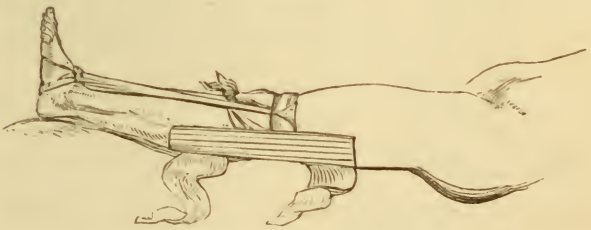
Use. — To support the limb and keep the foot extended, as in ruptured tendo-Achillis.

COMPOUND METATARSO-ROTULAR CRAVAT.

Composed of four cravats; — a hollow pasteboard or split deal splint; — some soft compresses.

Application. — The patient's limb should be placed in the most complete extension, and the heel kept elevated above the level of the tuberischi by means of a pillow. The centre of the first cravat is to be applied against the anterior part of the thigh immediately above the patella, its extremities carried backward, crossed, and returned to the anterior part of the leg immediately below that bone; by drawing on these, the two broken surfaces will be placed in tolerable apposition. The centre of the second cravat should then be applied against the sole of the foot, one extremity loosely knotted upon the metatarsus, and the other subse-

Fig. 130.



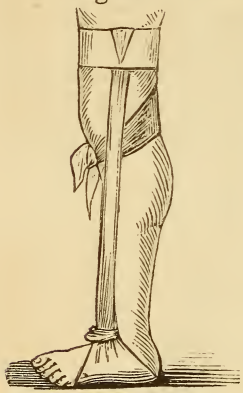
quently carried upwards on one side of the knee to the supra-rotular portion of the first cravat, to which it is to be attached, as seen in the wood-cut. The sole of the foot here serves for a *point d'appui;* and this second cravat, aided by the respective positions of the leg, of the thigh, and of the pelvis, tends to counterbalance the action of the extensors of the leg; but, to obviate still more any possibi-

lity of flexion of the latter upon the thigh, which these cravats would not in all instances be enabled of themselves to counteract, recourse is had to a hollow splint, which is well lined with soft compresses, and applied against the posterior surface of the limb. This is fastened in the simplest manner by the two remaining cravats.

Use. — In fractured patella, incised wounds of the knee, &c.

TARSO-PATELLA CRAVAT.

Fig. 131.

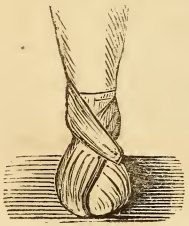


Application. — One handkerchief in a cravat around the knee in a figure of 8, so as to embrace the patella, the middle of another being under the instep, and one end tied on the outside of the instep, the other is passed under the cravat at the knee, as in the figure.

Use. — In fracture of the patella.

MALLEOLAR PHALANGIAL TRIANGLE, OR CAP OF THE FOOT.

Fig. 132.



Application. — Base of the triangle under the instep, summit over the toes, angles around malleoli to enclose the whole foot.

Use. — To retain dressings to the foot.

TIBIO-CERVICAL CRAVAT, OR SLING.

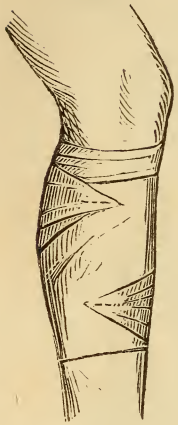
Application.—Apply the body of a cravat to the shoulder opposed to the side affected; bring down the tails obliquely to just above the crest of the ilium of the side corresponding to the injury, so as to give it, when knotted, the appearance of a band. Then, flexing the leg to a right angle, apply a triangle to its anterior face; the base corresponding to the ankle, and the summit to the knee; then carrying the tails, one along the inside, and the other along the outside of the thigh, attach their extremities, securely, to the cervical cravat, near the pelvis.

Use. — To support the limb after the treatment of fractures of the leg, or in sprains where the patient is desirous of walking about.

Fig. 133.

TIBIAL CRAVAT.

Fig. 134.



Application. — Place the body of a broad cravat obliquely across the back of the leg, and carry one extremity round the leg below the knee, the other above the ankle to meet and tie, or pin on the front of the calf, or spine of the tibia.

Use. — To confine sinapisms, blisters, &c., to the calf. The figure of 8 turns of this handkerchief prevent its becoming deranged by the movements of the patient.

BARTON'S HANDKERCHIEF.

A very excellent method of making an extending band for the treatment of fracture of the thigh, has been proposed by Dr. Rhea Barton, of this city. Dr. Barton was led to this application of the handkerchief by seeing how well the pressure of the boot on the heel and instep was borne, and how frequently excoriation and troublesome ulceration of the heel followed the use of the ordinary band or gaiter, which pressed directly on the sharp edge of the tendo-Achillis. With these views, he folded a handkerchief into a narrow cravat, and placed the body of it, directly on the extremity of the os calcis below the tendo-Achillis, so that two-thirds of the cravat came round under the outer malleolus, and the other third remained

on the inside. The inside portion remains parallel with the sole of the foot until the outside piece is carried over the instep and passed around it, forming a sort of knot, and also passed under the sole of the foot, to be turned around the first turn of itself, and form a knot at the metatarsal articulation, when both ends are carried off perpendicularly from the foot and fastened to the splint, the pressure coming directly on the instep and point of the heel, as seen in the Figs.

Fig. 135.

When ulceration on the front of the ankle-joint, or on the heel, has been produced by the use of the ordinary means, this will be found to avoid the sore points, and yet keep up a permanent extension.

We have now given an account of the manner in which Mr. Mayor employs the handkerchief as a substitute for the ordinary roller; and in order to preserve the continuity of his ideas, will here offer (what might perhaps with greater propriety come under another head) some of his remarks on the Hyponarthecia, or peculiar means of treating fractures, including a detailed account of his clinical frame, our wish being to offer as great a variety as possible of the means of treating surgical injuries, believing that each one will take from them what may be most desirable.

"In 1812 Mr. Sauter published, at Constance, a

work entitled '*Instructions for treating safely, commodiously, and without splints, fractures of the extremities, particularly the complicated ones and those of the neck of the femur, by a method new, easy, simple, and economical.*' This work, published in German, was somewhat voluminous; and in order to render the subject matter more intelligible, M. Mayor translated freely whatever appeared to be the most prominent features of this novel invention, and published them in the work from which we have taken his system. Perceiving fully the advantages that might be derivable from the new system, he adopted it exclusively, and having submitted it to the test of fourteen years' experience and observation both in the Hospital of Lausanne and in his private practice in the Canton, which was very extensive, he published, under the title of "*Mémoire sur l' Hyponarthécie,*" the various modifications he had deemed necessary, to give to this mode of treatment its greatest efficiency. His reasons for adopting the term *Hyponarthécie* (υπο, under; ναρθηξ, splint) were based upon the fact that the *planchette*, or Schebmachine, or support of M. Sauter, upon which the limb reposes, was in itself a splint. This term is expressive of the system, and has therefore been anglicised.

"To set out, the problem proposed by M. Sauter, a problem so difficult that it almost seems a paradox, but which he has ably resolved, was "*to treat a broken limb, with even the most serious complications, by position only, and without the use of splints; and to permit the limb, at the same time, to execute, without pain or inconvenience, every movement parallel to the horizon.*"

Now, to effect this important object, recourse is to be had to a board properly cushioned, upon which the injured limb should be placed, and fixed in the position which it is necessary to give it; the board thus charged, is attached to the ceiling or the top of the bed by means of cords, which are run through holes pierced in its borders and suspend it above the bed, so as to allow it a free horizontal motion. For the purpose of fastening the limb, two or three cravat-shaped ligatures are employed, which, in case of need, and with a certain modification of this apparatus, namely, a foot-board or ladder, will equally serve for the execution of traction or *extension*. But these ligatures, besides fixing the limb, exert a specific action upon the fragments themselves; for, acting in contrary directions, they keep the fractured ends of the bone themselves, as well in juxta-position, as in the most complete immobility: so that this simple contrivance not only effectually produces the necessary traction in the axis itself of the bone, but even similar tractions directly transverse to it; an advantage by which it is distinguished above all other apparatus for fractures. This state of immobility is importantly seconded by the soft cushion, which, by moulding itself to the form of the limb, guarantees the security of its under part, or that which alone can be said to be excluded from the direct action of the transverse ligatures.

But how, it may be asked, are the involuntary muscular efforts of the limb to be controlled? The answer to this is, that they soon terminate even under ordinary circumstances, and they do so in this case so much the sooner, as they are not

stimulated and kept up by the weight or offensive pressure of ordinary apparatus.

As the whole limb rests exposed to view, the inspection of the practitioner will discover at once the slightest possible displacement, which he will be enabled to remedy with the utmost facility ; at the same time that he may employ every kind of therapeutic agent in the event of injury of the soft parts. And the patients possessing, even under the most serious complications of their fractures, the faculty of horizontal motion, their beds can be easily made, and all the other necessary offices readily performed.

Not the least advantage peculiar to this apparatus is its ready construction ; it may be made at all places and under any circumstances, even by the practitioner himself; for if, viewing the materials in detail, some of these may not be at hand, such, for instance, as the pulley for the cords to run through, affixed to the ceiling, or the hinges necessary to a jointed board (see cuts), or a gimlet to bore the necessary holes, substitutes may be instantly found ; as, a staple for the first, a bit of strong leather for the second, and for the third, a few nails, by which the cords may be effectually fixed to the edges of the board. So also with respect to the cushion, how many substitutes may be found for this ! In short, whether a surgeon be called for, in scenes of the greatest poverty, on board ship with the fewest possible resources, or in the wildest districts, he need never be embarrassed.*

* On board ship it is especially serviceable, as the fracture is not easily deranged by the motions of the vessel, owing to the limb being allowed to swing as well as the body.

The reduction of fractures, by the employment of this suspension apparatus, is effected thus. The board being furnished with its cushion, which should be sufficiently thick to constitute a soft bedding, and entirely cover it, and the vertical cord, forming a loop, properly suspended from the ceiling; the second cord, destined to form the side loops, or arcs of the board, is to be run through the holes perforated through the angles of this, passing in its course through the first or suspension loop, so as to be in readiness to comply with any exigencies, in regard to length, when the suspension is about to be effected. This done, the limb is made to glide along the cushioned board; and then the resistance, or *counter-extension* and traction, is resorted to, together with the coaptation of the fragments; and, by means of the traction-bands, the position and coaptation of the fragments is fairly established. The ladder or foot-board, or extension band, will now keep the foot steadily fixed, while the due elevation given to the centre of the jointed board, if this be used, will constitute it an excellent double-inclined plane, possessed of all the advantages accorded to that species of apparatus. Lastly, the arc-loops and suspension loops are to be regulated so as to raise the limb to a proper height, which will be judged of by the surgeon, in consulting at all times, however, the feelings of the patient.

As this kind of apparatus is in the way of the bed coverings, some little tact is requisite to overcome this trifling impediment; but nothing need be observed on the subject here, as the good sense of the practitioner will always readily suggest

means to remedy an inconvenience so truly unimportant.

The use of the jointed board is strikingly evident in fractures of the femur, whether of its shaft or neck: it effects, in its quality of double-inclined plane, that which *modern* surgery only has succeeded in obtaining; namely, permanent *Extension*, joined to double *Flexion*, and the *Fixing* of the entire limb: but, besides this, suspension affords the utmost facility of motion in mass, by means of *lateral action*. It will be only necessary to observe this apparatus, as illustrated in the cuts, to be convinced how effectually the above important objects are attained, and how totally impossible it must be for the fragments of the bone to ride in cases of oblique fracture, by reason of the powerful aid of the pelvic bandages.

Even in fractures of the upper extremities, the hyponarthecic apparatus may be sometimes advantageously employed; as, for instance, where the fracture is one of very serious character, and complicated, with injuries of the soft parts, which requires that the patient should keep his bed, and which precludes, from what cause soever, the application of ordinary apparatus, as tending to aggravate his sufferings, and augment the difficulties of the case. In short, the only circumstances in which the invention of M. Sauter is contra-indicated, are those in which infants or maniacs are concerned, for reasons which the least consideration will render apparent.

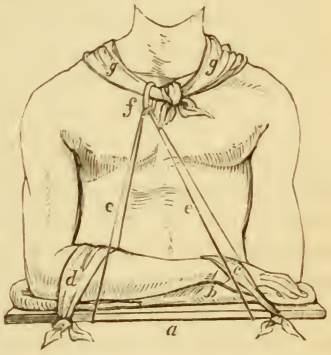
ANTE-BRACHIAL HYPONARTHECIA.

Composition. — A board of convenient width,

a little longer than the forearm and hand; — a cushion; — a cord for arc-loops; — and three cravats.

Application. — The fracture being reduced, the forearm is made to repose on the cushioned board, *a b*, which is immediately put into suspension to the patient's neck by means of the arc-loops, *e e*, ring, *f*, and CERVICAL CRAVAT, *g*. The second cravat, *c*, is now passed under the wrist and crossed upon the back of the hand, the tails being then made to embrace the cushioned board, and knotted at its anterior border, as represented in the woodcut. That done, the third cravat, *d*, is made to pass round the apparatus at its upper part, so as to confine the corresponding portion of the forearm, and be knotted also at its anterior border. Should it be deemed expedient, a fourth cravat may be made use of, to serve for a *traction-band*, which will of course be knotted at the inner border of the suspension-board.

Fig. 136.



The advantages that may be derived from the hyponarthecic apparatus, may here be judged of; for in cases of fracture complicated with laceration, or other injuries of the soft parts, even occurring

at the upper extremities, the wounds remain under the constant inspection of the practitioner, and are not subjected to the incommodious and even dangerous pressure of the common bandage, as must be the case when recourse is had to it under such circumstances. The patient may even be permitted, by the employment of this apparatus, to take exercise, when the injuries of the soft parts are not very grave; but if, on the contrary, perfect repose be deemed essentially necessary, instead of the above apparatus, a board should be procured, which, extending from the axilla to beyond the finger's ends, should be well cushioned, and maintained in place by means of a Bis-axillary Cravat. The board may then be put into suspension. The above cravat may be adapted to suit the object in view in the following manner: — The centre of the cravat should be applied to the axilla of the sound side, its tails carried before and behind the chest to the opposite shoulder, crossed thereon, and then brought down, one on each side of the deltoid, to the upper part of the board, the extremities being made to pass through a mortise perforated in each board, in order to be knotted underneath.

The bands for fixing, and the traction bands, may then be adapted according to the principles of the system.

With respect to the suspension, in such a case it may be made either from the ceiling, or the top of an ordinary bed; or if the hospital-bed be employed, as described hereafter, from the *suspension-bar* attached thereto. A precaution perhaps not unnecessary to be given, with regard to

the cushion, is, that this should be of sufficient length to allow of its being turned downwards at its upper part, in order to protect the axilla from the pressure of the extremity of the board.

This last apparatus will of course be equally applicable to fractures of the humerus, if complicated with severe injuries of the soft parts, but where a carved splint, as spoken of hereafter, can be obtained, it offers such advantages as must prevent frequent recourse being had to this of M. Mayor.

HYPONARTHECIA FOR THE TREATMENT OF FRACTURES OF THE LOWER EXTREMITY.

This consists of a straight board, furnished with a cushion, and suspended, something in the manner of a scale-beam, from the ceiling or top of the patient's bed, by means of cords; its object being to give support to a fractured limb, and allow of lateral movement.

The only thing which distinguishes this from other kinds of apparatus, is the suspension. The first thing to be shown, is the method of constructing it, and the advantages to be derived from its employment; the next, its adaption to the limb according to the nature of the injury.

CONSTRUCTION.

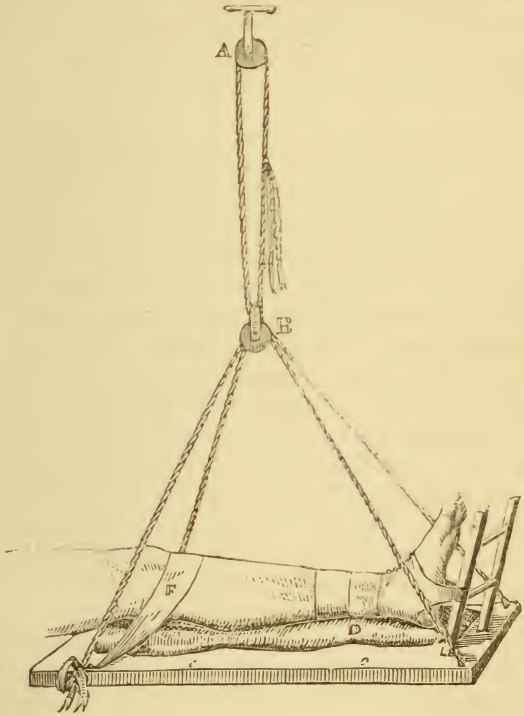
A thin board must be procured, proportioned in length and breadth to the size of the limb, as in Figure 137; it should be a trifling degree broader, and a few inches longer than the limb. Thus, for

Fig. 137.

fractures of the leg it should extend from the bend of the knee to three or four inches beyond the heel. This board should be covered by a cushion, of its own magnitude, made of oat-chaff, bran, cotton, hair, tow, or, in short, of anything that could answer the same purpose, and be readily procured: and it should have sufficient firmness to afford a plane of some resistance to the limb, and yet be capable of moulding itself exactly to its form. A hole is to be pierced near each of the angles of the board for the passage of the suspension cord, as at *c*. Each end of the cord is then to be introduced through the corresponding holes at one extremity of the board from below upward, and after being drawn to the same length, passed from above downward through the holes of the other extremity, and firmly knotted. The cord will thus form two parallel bows of equal length, which, by being held at the middle, will suspend the board as a perfect plane, or allow of its receiving more or less inclination either way, according to the distance, on one side or other of the centre, upon which the point of support is made to act. The support here spoken of consists of another cord, one end of which is to be carried through a staple driven into the ceiling, above the injured limb and

the other made to pass under the collected bows. By pulling, in contrary directions, the extremities

Fig. 138.



of this second cord, the board may be elevated to the necessary degree; and by knotting them, the elevation thus obtained steadily preserved.

Instead of the staple, it is better to employ a

pulley, if it can be had, as seen in Figure 138. A pulley would likewise be found more convenient for the connexion of the perpendicular and transverse cords, as seen in the Figure at B. The first of these pulleys will afford greater facility in the elevation of the board, while the second will serve to give it the due degree of inclination, with but little effort, and without occasioning the slightest shock.

As the free sliding of the cords would be detrimental to the treatment of this case, from the circumstance of the board being liable to alter its position by the least movement of the patient, it is advisable to tie the two bows together near the pulley, and introduce between the latter and the ligature a small splinter of wood, which will naturally prevent the bows from retrograding.

These preliminary arrangements, with the exception of the introduction of the splinter, or footboard, should be made before the limb is placed upon the board, in order that it may be immediately elevated when the former is applied upon the cushions. Care also should be taken to arrange beforehand the patient's bed, by pressing it down at the part corresponding to the apparatus, in order that his horizontal movements may not be interrupted. As soon as the limb has been elevated to a certain height, it is advisable to place a pillow underneath the board, which should remain there till the fracture is reduced, and the position, &c., of the limb conveniently arranged. This apparatus, when isolated, yields to the slightest impulse imparted by the patient in his movements, without occasioning either shock or pain.

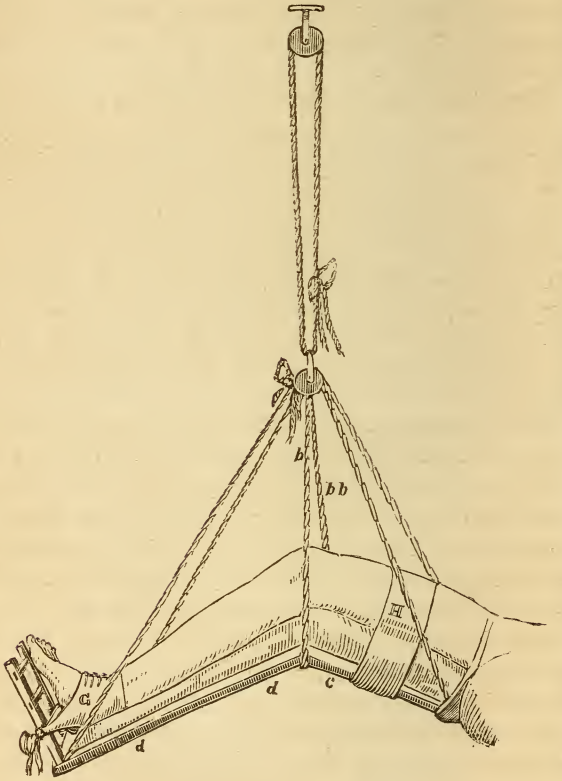
The facility which patients have of moving themselves in this way is so great, that, as M. Mayor has remarked, they may be seen changing their position with the utmost facility, obeying, through means of the common utensils, the calls of nature, and even gliding upon another bed of equal height.

Nevertheless, as may be readily conceived, it would be imprudent to permit them to indulge in any inconsiderate movements, as this would occasion and keep up in the osseous fragments a mobility that would become an obstacle to their consolidation. When, therefore, it is found impossible to suppress the indulgence of such imprudent movements, the surgeon must have recourse to the bandage of Scultetus, with the aid of splints, or else to the carved splint, to be spoken of farther on.

It may thus be seen, that in fractures of the leg, where the suspension apparatus presents the most advantages, a simple board suffices if it extends from the bend of the knee beyond the heel. A simple board arranged in the same manner, and which, departing from the tuberosity of the ischium, would pass a few inches beyond the heel, would also be equally sufficient for a *fracture of the shaft of the femur*, if it was considered proper to place the limb in an extended position upon its posterior face; but for those surgeons who prefer the demi-flexion of the leg upon the thigh, and the latter upon the pelvis, the following apparatus becomes indispensably necessary. Two boards must be procured, the one precisely similar to that called *tibial*, of which mention has been already made,

represented in Fig. 138; the other *femoral*, as in this figure, extending from the ham to the ischiatic

Fig. 139.



tuberosity, and articulating with the preceding, either by means of hinges, or simple tapes, which should pass through the holes with which the ex-

tremities of these boards are pierced, and be knotted underneath. The suspension of this double inclined plane is effected in the same manner as the simple tibial board, with this difference only, that the two bows are extended from the superior extremity of one of these boards, to the inferior extremity of the other. But in order to form the two inclined planes which are to support the limb in demiflexion, a small cord should be passed from below upward, through one of the holes of the upper extremity of the tibial board, as in the figure, across the point of support, and thence, from above downward, through the other hole of the same extremity, under which the two ends should be knotted together. In this way the extremities of the two boards, corresponding to the bend of the knee, may be made to describe an angle, more or less acute, according as the limb is required to be placed in a greater or less degree of flexion.

When position alone is sufficient to maintain the fractured extremities of the bone in apposition, and it is indispensably requisite to exert continued extension, or, in short, when more solidity is required to be given to the apparatus, the femoral board should be shaped out at its internal and superior angle, and furnished with a belt, which will be spoken of farther on.

The boards thus arranged, are not only useful in fractures of the shaft of the femur, but also in the treatment of fractures of the neck of that bone; as they fulfil perfectly, in presenting two inclined planes for the flexion of the thigh and leg, the indication of the pillows of Sir Astley Cooper, and the machines of Sir Charles Bell, Earle, Del-

pech, and Smith, of Baltimore, which have the inconvenience of being much more complicated, and consequently of less easy and general application, particularly in places distant from large towns. In short, one of the advantages for which the suspension apparatus is deserving of being made known, is its simplicity, and its possibility of being constructed at all times, and in all places. In country practice, says M. Mayor, in isolated districts, every portion of this apparatus may be readily procured without occasioning the least embarrassment to the surgeon.

"For myself, I may say," continues this gentleman, "I have never experienced the slightest difficulty. I have sometimes substituted any common bands, when the proper cords failed me; I have nailed these to the board when I have had no instrument to bore the ordinary holes; I have employed nails for screws, and to form the directing bands, tow, wool, or rags; these last materials, as also bran, sawdust, moss, and even soft hay, have served me in constructing my cushions for the boards; the bark of a tree, moistened leather, the binding of an old book, have supplied the place of pasteboard; and rope-ends, skin, or strong cloth, have not unfrequently replaced the metallic hinges."

The double-boarded apparatus, it may be observed, will be found extremely useful in the case of fracture of the leg, with tendency to displacement, more especially when this occurs near the knee-joint, from the impossibility of applying the garter, (*jarretière*,) one of the directing bands of which mention will be made farther on.

Although particularly applicable to fractures of

the limbs, the suspension apparatus of M. Mayor may, under other circumstances, be of important use. It will readily be conceived how great might be its utility in any painful diseases seated upon one or other of the limbs, as well as in certain white-swellings, in arthritic and rheumatic tumefactions of the foot, or in any other serious affections of the knee, or of the articulation of the foot and leg. Its use might be extended to the treatment of transverse wounds of the thigh, or of the tendo-Achillis, for which the most perfect immobility is indispensable. There cannot be a better means, so long as the immobility of the fractured part is insured, of allowing the patient to vary his position in bed.

ADAPTATION.

It is not sufficient, although assertions of this kind have constantly been made, to place a fractured limb, after its reduction, upon an immoveable plane, in order to effect the cure. If this were true, for very simple cases, which would be but exceptions, if, for instance, in the majority of cases of simple fracture of the femur, a convenient position and a retentive bandage might be made to replace all those complicated machines, which do more honour to the mechanical knowledge of their inventors, than to their knowledge of physiology; it is not the less certain, that other means are required also, to maintain the fractured extremities of a bone in perfect contact, to overcome the involuntary as well as the spasmodic contractile efforts of the muscles, and the indocility of the

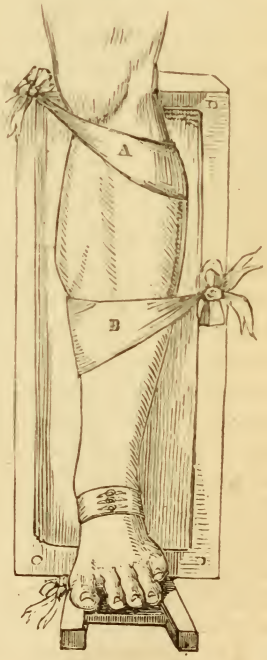
patient. But between these indications, and the necessity of violently extending in contrary ways the two extremities of a limb, by mechanical powers which resemble only the rack of the inquisition, there is as wide a distance, as between the *glossocôme* of the ancients and the simple pillows of Sir Astley Cooper: the surgeon who does not dare to expose himself to the dangers of the first, or to the insufficiency of the second, has recourse in cases to the extension apparatus of Dessault and others, which are not, however, free from inconvenience, but more often to the simple directing bands of M. Mayor, to which the only real objection that can be made is, that they are *sometimes* insufficient.

In the greater number of cases of fractured limbs, the fragments face each other; whence the necessity, of exerting pressure in the direction of their diameter, if the displacement exist in relation only to the axis of the body of the bone, or of pulling at the same time at the lower fragment, if the displacement is longitudinal, or in other words, if the broken ends overlap, in order to effect their coaptation. The hands alone of the surgeon and assistant are sufficient to fulfil effectually these indications; but as they are only temporary means, recourse must be had, in order to render the effects permanent during the whole time necessary to the consolidation, to the aid of an intelligent machine, if such an expression may be used, which, in accomplishing this end, will in no respect inconvenience the patient.

Let the fracture of a leg be taken as an instance; if it be of such a nature as not to exact the con-

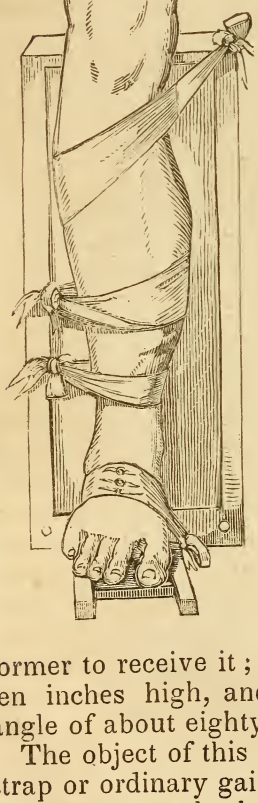
tinued extension of the limb, and position alone suffices to maintain the broken ends in apposition, the surgeon has only to confine himself to the application, below the knee, of a tie or *garter*, the central portion of which has merely to be applied upon the anterior, or one of the lateral faces of the limb, and its ends attached either separately on each side, or together, on the outside or inside of the board (A). The object here in view, as will be easily perceived, is to fix the limb upon the board and give a due direction to the superior osseous fragment. The garter, like all the other directing bands, may be made of a bit of common roller, or a longitudinal compress, but M. Mayor prefers those he ordinarily employs. These directing bands, the form of which may be seen in the figure, should be thick and soft, in order to preserve their shape, and prevent them from exercising a painful pressure. They should be constructed of two pieces of linen cloth, from three to five inches wide at the middle, with a layer of wadding, char-

Fig. 140.



pie, tow, or wool, interposed between them; to the two extremities of these bands should be sewed tapes of convenient dimensions, or padded handkerchiefs will do as well. The figure indicate so clearly the manner of disposing them, that it is unnecessary to dwell upon them longer here: the place, however, they are to occupy upon the limb, will be spoken of by-and-by.

Fig. 141.



When these simple bands are found insufficient to fix the limb solidly upon the board, or when it is necessary, in order to maintain the fracture reduced, to exert continued traction on the limb, the following pieces must be added. To the inferior extremity of the board above spoken of, a foot-support is to be adapted, of the shape of a ladder, as in the Figure 137, by means of mortises, *a a*, pierced in the former to receive it; it should be from eight to ten inches high, and form with the board an angle of about eighty degrees.

The object of this foot-board is to fix the heel-strap or ordinary gaiter, which, on one hand, embraces accurately the instep, heel, and malleoli,

and on the other, is attached by means of the two tapes, which terminate it, to one of the sides of the ladder, according to the direction desired to be given to the limb.

Thus, by means of the gaiter on one hand, and the foot-frame and heel-strap on the other, the elongation of the limb may be produced, and the overlapping of the factured ends effectually prevented. The extension being made, is maintained by the heel-strap, and the counter-extension by the garter, or band at the knee, without taking into account the weight of the body, and the fixture of the limb upon the apparatus; while the heel-strap, by fixing the foot, prevents rotation, inwards or outwards, of the lower fragment.

But this alone is not sufficient to restore the limb to its natural form when the fragments are displaced in respect to the diameter of the bone; and although the shortening of the bone has been provided against, nothing has yet been done to maintain the fractured ends in apposition. The following is the manner in which this indication is to be fulfilled; instead of resorting, as is generally the case, to the uniform pressure exerted by the eighteen-tailed bandage, or that of Scultetus, with splints applied upon the soft parts that surround the ends of the bone, M. Mayor has recommended a means much more simple and more efficacious, and one which offers, besides, the advantage of not covering in with the apparatus the part of the limb at which the fracture is seated; permits the surgeon also to visit it as often as he pleases, without the help of an assistant; and to remedy the displacement, if any such should have occurred, as well as to dress the wound, should

one exist, without meddling with the apparatus. The means in question consists in placing upon the part of the limb toward which the end of the bone is directed, and where it makes projection, the centre of a directing band, as in Fig. 140 (B); and fastening the extremities to the opposite side of the board; care being taken, however, to see that the fracture is properly reduced. Two bands, which act in opposite directions, are occasionally necessary, but more frequently the desired effect is obtained by one alone. The middle of the band should be applied upon the most convex part of the deformed limb; one of its extremities is to be passed immediately under it, the other over, and both drawn with sufficient force and fastened to a peg, inserted at the side of the board which corresponds to the concavity of the limb, or in default of this, to a mortoise pierced about this spot; they may be even nailed at once to the board.

The directing bands should not be placed until the heel-strap and garter are adapted, the latter being fixed to the board upon the opposite side to that toward which the neighbouring band is to be directed; without attending to this, the two extremities of the limb would be found to yield to the inverse tractions of the bands. The disposition of these several pieces is seen in the Figures 140, 141. In comminuted fractures with extreme tendency to displacement, a piece of pasteboard should be applied upon the anterior part of the limb, as in Fig. 142, the notched end being intended to touch the front of the foot.

Fig. 142.

To fix the femoral board more solidly, the surgeon should apply the large quilted band, or padded handkerchief before spoken of. This band should be of sufficient length to pass as a belt round the body, and terminate by a strap, to be attached to a strap and buckle, fixed to the external and superior part of the board. This band serves at once as a body-bandage and perineal strap; it passes first of all upon the groin of the injured side, then round the corresponding ilium and along the back, and is returned over the pubes to the upper part of the fractured thigh, where the buckle, fixed to the outer side of the board, receives it, or where, when this is wanting, it may be fastened to some other convenient point of attachment. This belt, which, as may be perceived, tends to fix securely the femoral board upon the pelvis, is employed with the notched portion of the board, against which the tuberosity of the ischium rests, to produce the counter-extension, or, in other words, the resistance necessary to meet the tractions of the heel-strap; while the latter acts at the same time upon the limb which it elongates, and upon the board which it pushes upward, first beneath the ham and then upon the ischiatic tuberosity. Lastly, it is this portion of the apparatus which performs the greatest part in the effort; but as it is aided firstly by the weight of the limb, which, placed upon an inclined plane, tends to descend, and secondly, by the effort itself, which tends to elevate the bend of the knee, there can be no reasonable apprehension of the formation of sloughs or excoriations, such as the ordinary machines for continued extension too frequently produce.

This apparatus appears to unite all the qualities necessary for the reduction and consolidation of fractures of the neck of the femur.

"To resume; when it is required to maintain a reduced fracture of the femur, of whatever nature it may be, whether situated near the knee, or in the shaft or neck of the bone, whether simple or complicated, with or without obliquity of the fragments, the thigh and leg are to be extended over the inclined plane, well cushioned, the belt applied round the thigh and pelvis, and the foot attached to the ladder or foot-board inserted in the lower end of the tibial board. A large quilted band, or several handkerchiefs, embrace the whole apparatus to confine the limb upon the board, when there is no deformity; or the bands of direction, already described, made use of when the limb is curved, or there is any tendency to curvature."*

With a view of raising patients in bed, when suffering from injuries to the lower extremities, Mr. Mayor proposes a Clinical Frame, which, from its simplicity, has many advantages over the complicated machinery of Earle, Jenks, &c., and may be advantageously used, especially by our army surgeons, as it offers an excellent bed, under even ordinary circumstances, being more steady, and not liable to the objections of an ordinary hammock.

In speaking of it, he says: — It is, doubtless, highly gratifying to have at our service, as practitioners, a number of easy and convenient kinds

* From "*Nouveau Système de Deligation Chirurgicale.*"

of apparatus, as well as appropriate and salutary therapeutic agents; but there are circumstances in which, if we have the latter at command, the former are by no means so much in our power; whence it happens, that we are occasionally called in, under circumstances so perplexing, nay, so truly desperate, that we are content with positive inaction, rather than allow our interference to add to the patient's sufferings.

A large number of serious affections are daily met with which not only compel the patients to keep their bed, but even place them beyond the possibility of being removed from one part of the bed to the other, without their being subjected to the most excruciating pain, or even to actual danger. Whether they repose then upon a bed of eider-down, or are stretched upon a hard paillasse, these unfortunate individuals soon experience the want of having their bed better arranged, and of being replaced in a position more supportable. They are excoriated at all those places where the bones project, as at the sacrum and the hips; the skin, deprived of its subjacent fatty tissue, constantly and powerfully pressed against the bones, soon becomes irritated, and ultimately sloughs; whence result those deep and extensive wounds, which, incessantly exposed to an invariable, and one might almost say corroding, pressure, to the difficulties attendant upon their dressing, and, still worse, to the continual contact of urine and fæcal matter, sometimes finish existence of themselves, or rapidly abridge its duration.

For the purpose of averting these serious incon-

veniences, various mechanical beds have been invented, the most ingenious of which tend to elevate entirely, and with great gentleness, the unfortunate sufferers whom it would be impossible to move with the hands or any other means, without occasioning the most heart-rending cries.

It will readily be conceived, that the hands of one, two, or even three persons, are wholly insufficient to support the entire body of an adult; that the parts which are not sustained must be put upon the stretch, while the others are pushed up, and that, from this unequal manner of action, the most excruciating pains ensue. And let it be, moreover, remarked, that the fingers do injury from their hardness; while, in addition to all this carrying to and fro of the body of the sufferer, the most disagreeable shocks are constantly occasioned, which infinitely augment his already intolerable pain.

In point of fact, patients in general prefer supporting the whole of the serious inconveniences allied to their actually invariable and painful position, rather than expose themselves, by this lifting about, to absolute tortures; more especially when this has to be effected frequently.

Circumstances so melancholy have necessarily had the effect of awakening the solicitude of practitioners, the industry of patients themselves, and the compassion of those who are about them to contribute, if possible, to the palliation of such tortures, or at least to attenuate some of their more fatal consequences.

But it has been more particularly in favour of the minority, that is to say, of the opulent, that

such efforts have been crowned with success; the lower orders of society still remaining without the pale of benefits arising from the invention of machines calculated to be of avail in circumstances such as those just pointed out. The reason of this is evident; the means indicated, and known under the title of Mechanical Beds, are so complicated and so costly, that they can only be within reach of persons in easy circumstances; and even in hospitals, these beds are generally few in number, and their use very limited.

So great, therefore, is the difficulty of obtaining these different kinds of apparatus, and still more the difficulty of adapting them to the exigencies of the most numerous classes of the community — classes which, be it observed, are the most constantly exposed to affections demanding contrivances of this kind — that it has been of the utmost consequence to consider other means, than such pieces of mechanism present, and to seek for what seems to have been, hitherto, wholly lost sight of, namely, a contrivance within the reach of every individual, and applicable in every circumstance. This desideratum, M. Mayor thinks, will be found in his Clinical Frame, which he thus describes.

The first things to be sought for, are two narrow boards or poles of about the length of the patient, and two crossbars of the same nature, of about a yard only in length. With these four pieces of wood, which may be easily united at their extremities by means of nails, rivets, bits of cord or handkerchiefs, we shall be immediately in possession of a frame in all respects stout enough for the

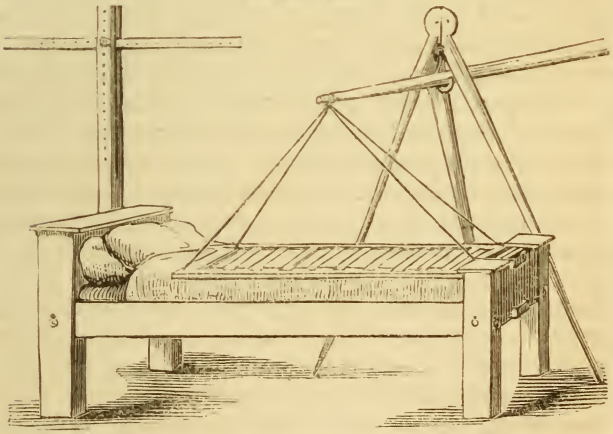
end in view. It now remains to fill up the intermediate space; and recourse must here be had to bands of webbing; but if these should not be at hand, or at all events, should they be difficult to obtain, a few stout cravats would conveniently supply their place. Whether, then, the webbing bands or the cravats be employed, they must be arranged crosswise, fastened securely at their extremities to the sides of the frame, and, above all things, possess sufficient strength to resist the weight of the patient when suspended in the air. Substitutes for the above materials may be equally found in towels, napkins, sheets, or indeed in any thing that would serve to constitute a bottom, soft, but yet sufficiently strong. After such simple data, it would be superfluous to point out how ingenious mechanics might modify the contrivance so as to prepare a frame more elegant, more in harmony with their own talent, their desire of gaining reputation, or indeed with the fortune of those who employ them; on the contrary, it would be advisable to urge the necessity of preserving the same simplicity in the construction of this, which will be found in the means destined to effect its elevation; for there will be quite enough of those who are ever on the alert to throw a species of luxury about a machine, who will believe that they have perfected this, when, from a simple and effective instrument, they will have converted it into a complicated one despoiled of its best qualities.

To raise the frame, as well as the patient, who is supposed to be stretched upon its bottom, it would be sometimes sufficient to employ two or

three dexterous persons, such as are met with in hospitals; but in addition to the difficulty of finding such assistants, there will be always more or less inconvenience attending this operation when effected by the hands, in consequence of the shocks to which the frame will be constantly subjected from the slightest deviation from a simultaneousness of action. It will, therefore, be found more convenient to have recourse to the means employed in the hyponarthecic suspension, and to apply to the whole body that which so well succeeds when applied to a limb.

Thus, the four angles should be perforated with four holes, as in the Fig. 143, through which a

Fig. 143.



strong cord will be run in order to form two kinds of parallel bows or arc-loops of suspension; the

one longitudinal, the other transverse; the former corresponding to the sides, the latter to the extremities of the frame.

Recourse may be had also to one loop only, which will give to the frame the kind of tilting (*jeu de bascule*) observed in the beam of a scale. Movements of this kind are occasionally of importance, as when it is desired to raise the upper part of the body much above the horizon, or even the lower part alone.

One strong vertical cord, firmly attached, and passing through a pulley, will suffice for the elevation of the frame charged with the patient, and must be arranged in the same manner as for the hyponarthecia of the extremities. Thus, in the dwellings of the poor, the ceiling is usually provided with large beams; nothing, therefore, will be found more easy than to arrange properly the staples or pulleys. Recourse may be equally had to a suspension bar of the kind represented in the figure, and placed at the head of the bed. But when these resources fail, or cannot be employed without some disadvantage, let that be remembered which is done by certain mechanics, particularly masons, when they desire to lift a heavy weight. The *tripod*, called generally the triangle, is the most easily constructed, the most firm, and in all respects the most convenient that can be employed for the object here proposed. This tripod, seen in the figure, should have a pulley attached to the iron hook observed at its upper part, or point of union, in order to receive the vertical cord destined to raise the frame, and, thus provided, should be stretched across the bed.

In order to render the ascent of the frame perfectly gradual and easy, the vertical cord should be made to pass round a cylinder, fixed to two of the legs at their upper part, which may be turned either by a winch, or, if provided with holes and a small handle, as a capstan.

Instead of this, if the free end of the vertical cord, after having passed through the pulley, be firmly secured to one of the legs of the tripod, the above effect may be accomplished by means of a strong stick, which is employed to twist the cord, and which, by shortening it at each turn, elevates the frame.

But a still easier method is to employ a simple lever of the first power, — a pole, for instance, — whose fulcrum should be beside the bed, and to one end of which should be fastened the arc-loops themselves, as seen in the figure, or, what is still better, the vertical loop, which will permit, during its elevation, the frame to be better balanced: in lowering, therefore, the other end of the lever, the ascent of the frame may be regulated with precision. The fulcrum, thus placed between the power and resistance, may be simply a rope's end made into a loop, and either firmly attached to the ceiling, or else to the tripod, which, in this case, instead of being stretched over the bed, should be placed beside it.

With the ordinary hyponarthecic loops attached to the Clinical Frame, which will allow of the point being varied where they are taken up by the vertical loop, we obtain, with the greatest facility, the power of elevating this frame in any direction we may choose, whether completely hori-

zontally, or with an inclination towards either of its extremities or either of its borders; an advantage which will not be without its utility on particular occasions.

It will be hardly necessary to observe that, in order to obtain these effects, it suffices merely to place the vertical cord at the centre of gravity itself of the frame, or more or less beyond this, in the direction either of the head or feet, and to make, for producing lateral inclination, the arc-loop shorter on one side than on the other. The arc-loops, however, ought to be collateral, for all these little advantages would be far less easily obtained, were the cords, which perform the office of loops, placed transversely at either of the extremities of the frame.

Like all frames destined for a clinical use, that just described may rest continually in place, in order that it may be raised at the moment desired, without previous preparation; that is to say, the patient should repose upon the bottom itself of the frame; or else this elevation may be applied at the instant only occasion may require it. In the first case, we should be careful that the bands or the pieces of cloth which constitute the bottom of the frame do not annoy the sufferer, and are preserved as clean as possible. This will not be difficult if preference be given to large pieces of stout cloth, which will occasion so much the less inconvenience, as they may be stretched at will, without forming any incommodious folds.

It will be clearly seen, moreover, that, with this disposition, the surgeon may readily expose the ulceration, and manage the application of dress-

ings, by displacing from the bottom of the frame that portion which otherwise masks the affected parts.

When, on the other hand, it is found advisable to apply and elevate the frame several times, recourse should be had to the webbing bands, which, by means of a broad, thin, pliant piece of wood, may be glided, at the very moment, under the patient, much in the same manner as we should change the bandelettes in the apparatus of Scultetus. These bands, already attached to one side of the frame by one of their extremities, are then brought to the opposite side, where they are fastened, by means of their free extremities, through the intermedium of ribands, buttons, or buckles. This simple and easy means of gliding the bands under the patient, without at all incommoding him, and thus interposing between the bed-clothes and himself some sort of bottom proper to sustain him when elevated, would naturally suggest a still more simple support, namely, cravats or oblongs, of whatever tissue they may be composed, or of whatever breadth it may be thought proper to afford them. The Clinical Frame may not only be regarded as a species of hyponarthecia, destined to sustain momentarily the entire body in any manner, or in any direction desired to be imparted, but, being moveable, it will be seen to offer one very precious resource in a circumstance of the most important nature. Allusion is here made to the frightful sloughing sores common to the lower and back part of the body, and which the pressure against the bandelettes renders insupportable, and tends constantly to exasperate.

Many are the means, without doubt, employed to attenuate this horrible pressure; yet they not only most often fail, but are difficult to procure, to maintain in place, and preserve in a proper state of cleanliness. The Clinical Frame, then, with very little additional trouble, averts this inconvenience in the following manner: —

Let the individual be extended over the bands placed transversely behind his back, and let us suppose that these bands are properly stretched from one side of the frame to the other; it is clear that the poor sufferer will press upon them all with his entire weight. But if we detach those bands which correspond to the ulcerations, and if, at the same time, we remove sufficient of the hair, wool, or straw of the mattress which exists under the bands we have just placed aside, we shall immediately obtain a sort of hollow or depression, in which the ulcerated surface will be but very slightly touched. It will be even possible to afford such depth and extent to this depression that the affected parts remain, as it were, in the air, in a complete state of isolation. In short, the bands, placed above and below the seat of ulceration, will sustain the body with great exactness, and will leave the sore open, and at that degree of elevation which may be judged necessary, to subtract it more or less, from the pernicious influence of the pressure we are striving to avoid.

It may be, however, observed, that, instead of the excavation already spoken of, the mattress may be cut across, and of one mattress two smaller ones formed, which may be placed so as to allow of a sufficient space between them to guarantee the wound from pressure, according to its extent.

The Clinical Frame may, in campaign, admirably serve for a litter, for the transport of the sick or wounded; it possesses the advantage of the most simple form of construction, and of being made of materials to be found on all occasions. In this case, instead of webbing or other bands, to form the bottom of the frame, recourse may be had to simple cords covered with hay, straw, leaves, grass, pieces of clothing, &c. When it is found necessary to have the litter stationary, nothing would be more easy than to adapt to it a tripod or triangle, which would possess two remarkable advantages; firstly, in forming solid feet for the support of such temporary bed; and, secondly, in forming a frame proper to receive a blanket, or something of the kind, to serve for the purpose of a curtain and to protect the sufferer from the sun, rain, wind, &c.

Many other occasions might, doubtless, be found for the use of this frame when put into suspension. Serving as a sort of hammock, it would seem to invite officers to establish it under their tents, and would guarantee them from the humidity of the ground, from insects, and other annoyances inseparable from a bed placed directly upon the earth. The same may be said of it in a bivouac, where the triangle need only be covered by a cloak.

The suspension-bar, as seen in Figure 143, adapted to a common hospital-bed, has been already pointed out as a means of establishing the suspension of a hyponarthecic apparatus: it requires no description, for the drawing will suffice to give the most correct idea of its construction.

It will be seen therein to represent, however, only one-half of it, as the drawing of the other half would have interfered with the view of the tripod.*

PART THIRD.

OF THE APPARATUS FOR THE TREATMENT OF FRACTURES AND DISLOCATIONS.

SECTION FIRST.

OF THE TREATMENT OF FRACTURES.

The proper treatment of these injuries is one of the most important parts of the surgeon's duty, and one from which no practitioner can escape, as not to be able to set a broken limb or reduce a dislocated bone, is enough to destroy entirely all professional reputation, the public not being able, generally, to understand the distinction drawn between the duties of the surgeon and those of the physician. Yet important as the subject undoubtedly is, it would be foreign to a work of this kind to treat of it in all its bearings; to consider its causes or its physiological and pathological changes; and I shall, therefore, confine myself to the consideration of such points as are connected with the treatment, briefly hinting at the views of

* From Mayor's "*Nouveau Systeme*," etc.

the different schools, and refer those who wish for a more minute knowledge of it, to the many articles on the subject to be found in all our works on Surgery.

The first part of the treatment is included in the different means of reduction by *extension* and *counter-extension.* Here there is considerable diversity of opinion, each being sometimes right and sometimes wrong: thus, the French surgeons apply the extending force to that part of the limb which is articulated with the lower end of the bone, and the counter-extending force to that which is articulated with the upper; their object in not applying these forces upon the fractured bone itself, being to avoid such an irritation of the muscles, as might cause a spasmodic contraction and impede the efforts at reduction; thus, in fractures of the thigh, their means of extension act upon the lower part of the leg, and those of counter-extension upon the pelvis; whilst the doctrines taught in the English schools, inculcate as a leading principle the necessity of putting the limb in a flexed position, or one capable of relaxing the more powerful muscles connected with the fractured bone, and of employing the extending and counter-extending forces so as to act upon the bone itself. This, however, was found defective in the reduction of some broken thighs, and preference was given to the former method. Other exceptions are also to be found to this plan of reduction, where, for instance, the application of the means of reduction at a distance from the affected part, is necessitated by the peculiar disposition of the part itself; thus, in fractures of the clavicle, the exten-

sion must be practised upon the arm and shoulder, and the counter-extension upon the trunk. Nor is the French mode, above mentioned, capable of universal application, as is seen in fractures of the lower jaw; extension in these cases being only made properly upon the bone itself. There are fractures, also, in which no extension is necessary, coaptation alone sufficing, the displacement being due to the external cause which produced the accident; such, for example, are those of the bones of the head, the nasal bones, the ribs, &c.

The *direction* in which extension is to be employed, is to be regulated by the displaced fragment itself; thus, in oblique fractures of the humerus, if the lower fragment mounts on the inside, the extension must be made obliquely downwards and outwards, then downwards, in order to restore it to its natural position, and the degree of force necessary to be employed is not appreciable, *à priori*, as it must always be in relation to the kind of displacement and to the resistance of the muscles of the part. When sufficient extension has been made, the broken ends of the bones are to be placed in their natural situation by the fingers, or, as is said, coapted; and the surgeon proceeds by acting upon the lower fragment, if in fractures of the limbs, to regulate their contact. Should he, however, deem it indispensably necessary to apply his fingers directly on the fracture, he should do it as lightly as possible, to avoid pressing the soft parts against the splinters, as this will cause spasmodic displacement.

With respect to the *means of keeping fractures reduced*, it is to be first observed that a multiplicity of causes would tend to disconcert the coaptation

of the fragments, were not effectual means resorted to by the surgeon for rendering them immoveable by the use of appropriate apparatus. Nor is the position of the part and even of the whole body a thing of small importance. "The most favourable position," says Professor Cooper, "for a fractured limb, is that in which all the muscles passing over the fracture, and extending either to the lower fragment or to that part of the limb which is articulated with it, are equally relaxed; the injured limb should also have a firm support at every point, and its position ought to be so regulated, that not only this object should be carefully fulfilled, but at the same time the chance of displacement from the action of the muscles, or the weight of the body or part itself, may be diminished as much as possible." The *bed* on which a patient ought to be placed, who is labouring under a fracture, should be narrow, so as to allow of the surgeon getting conveniently at the limb: and the patient should repose upon a mattress, and never on a feather-bed. Boyer recommends, as the best pillow for supporting a broken limb, one stuffed with oat-chaff; as he considers it less heating than a pillow of feathers, and also less apt to soil.

Dessault and Boyer recommend, in fracture of the thigh-bone, keeping the limb in a straight posture; and of the various apparatus invented for the purpose, those of these distinguished surgeons are perhaps of all others the best calculated to fulfil the indications proposed by this method of treatment. Pott considered the best position to be that in which the limb is laid upon its outside with the knee bent, the fractured bone resting on the great

trochanter, while the leg and foot are supported by smooth pillows, and slightly elevated. Considerable objection has of late years been made to Pott's method, principally on account of its leaving the lower part of the limb too moveable and unsupported, and imperfectly fulfilling the proposed indication, namely, of preventing disturbance of the coaptated fragments. Sir Charles Bell prefers placing the patient upon his back, and supporting the limb upon a double inclined plane, a machine constructed for this purpose, and consisting of boards ten or eleven inches wide, one of which reaches from the heel to the ham, and the other from the ham to the tuberosity of the ischium; these are united at the knee-joint by hinges, and their lower ends are fastened together by a horizontal board, cushions being placed upon the whole, and the limb left in a bent position. After the fracture has been reduced, a long splint is applied from the hip to the knee, and another along the inside of the thigh: and the lower part of the apparatus is furnished with a foot-board to prevent the foot from being turned outwards, and also to keep the limb steady.

Each of these methods has its partisans, but the general opinion here is decidedly in favour of Dessault and Boyer.

Whatever be the opinion of writers on these points, let it be recollected that the grand points in the treatment of fractures, are the reduction, and coaptation of the fragments, and the employment of some means to keep them in their proper position when thus reduced, and that with this view some one or more of the parts composing the different *Apparatus for Fractures* must be employed.

These consist of Splints, Cushions, or Junk-bags, Pads, Extending and Counter-Extending Bands, Palettes, or Hand Splints, Soles or Foot-Splints, Compresses, Pads, Slings, and Rollers. The minute directions for the preparation and application of each of which, will be given in connection with the treatment of the particular fracture for which they are required.

FRACTURES OF THE SKULL.

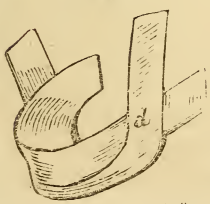
Here the dressing will depend on whether or not it has been necessary to trephine. But in any case where it is requisite to retain dressings to the cranium, we may resort to the *Recurrent Bandage of the Head*, the *Single or Double T;* the *Handkerchiefs of Mayor;* the *Bandage of Galen*, or to the *Sling of Four Tails.*

FRACTURE OF THE BONES OF THE NOSE.

After the fracture has been reduced by the use of a probe introduced into the nostril to elevate the bones if they have been depressed, we may employ the *Double T of the Nose*, to retain the dressings to the part, or to the internal angles of the eyes, and thus combat the inflammation of the nasal duct which so often supervenes.

IN FRACTURES OF THE LOWER JAW,

Fig. 144.



Anterior to its angle, we may employ *Dr. Barton's Bandage*, with the use of a pasteboard splint, as in the figure, or the *Sling of the Chin*, or the *Bandage of Dr. Gibson*, which is composed as follows: —

GIBSON'S BANDAGE FOR FRACTURE OF THE JAW.

Composed of a roller, five yards long and two inches wide, and of a compress and splint, if necessary.

Application.—After having carefully examined the injured parts, and replaced any of the teeth that may have been deranged, we should run the fingers along the margin of the jaw, in order to mould it into its proper shape. Then closing the mouth firmly, make the lower teeth press fairly upon the upper, and place a compress of moderate thickness under the fractured portion, where it should be held by an assistant. The surgeon next takes the single-headed roller, and commencing on the top of the head, passes it by several turns down the side of the face under the jaw, and over the compress; after the third turn of this kind make a reverse on one temple, so as to run off perpendicularly and surround the forehead and occiput by circulars of the vault of the cranium. On the third of these turns pass from the occiput obliquely over the back of the neck, and under the ear, to make three circulars of the chin and neck; from the neck pass obliquely upwards to go circularly round the forehead, and place pins at each turn. If the turns are likely to slip, fasten a small strip on the forehead, and carry

Fig. 145.

it over the vertex to fasten it to the turns on the neck, and thus secure them more perfectly, as seen in the figure.

During the treatment of fracture of the jaw, the patient must be fed on soft, semi-liquid food, and not allowed to speak; but there is no occasion for inserting a piece of cork between the teeth, or drawing any of them, as there is usually enough space between them as they stand to enable any one to suck food through them. This fracture, under favourable circumstances, consolidates in four or six weeks, but the patient should not eat hard or tough articles for some weeks afterwards, for obvious reasons.

FRACTURES OF THE VERTEBRÆ,

Require no apparatus. Our attention must here be mainly directed to the use of the catheter and of enemata, the use of which will be treated of hereafter. An important point to be recollected in these injuries is, not to turn the patient on his belly in order to examine the back, but to turn him only on to his side; for as the abdominal and intercostal muscles may be paralysed by the injury, the diaphragm alone can act in respiration, but, in order that this may descend, the abdomen must bulge out, so as to allow of the descent of the bowels and expansion of the chest. If, then, the patient is kept for a length of time on his belly, there is not sufficient force in the diaphragm to do this, as it has to overcome the resistance made by the weight of the body on the bed — consequently, if the examination is tedious, the patient will run the risk of being suffocated.

FRACTURES OF THE STERNUM.

The indications here are, to prevent deformity from the projection or depression of the fragments, and also to keep the chest at rest, and oblige the patient to breathe by the diaphragm and abdominal muscles. These may be very well fulfilled by placing a compress over the part, and confining the chest by the *Crossed Bandage*, or by the *Spiral of the Chest*, as has been before shown.

FRACTURES OF THE RIBS,

Are to be treated on the same principles, the compresses being over the parts, if the fragment projects externally, but over the end of the rib, if they are depressed. These compresses and the whole chest are to be confined by the *Spiral Bandage of the Chest*, Fig. 42, which should be drawn very tight.

FRACTURES OF THE PELVIS,

Require no other apparatus than a broad bandage of the abdomen and pelvis, there being here little or no tendency to deformity, owing to the attachment of muscles.

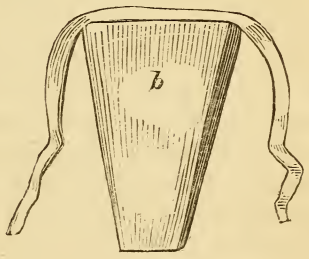
FRACTURES OF THE CLAVICLE,

Are treated by several kinds of apparatus, but all having for their object the keeping of the shoulder *upwards, outwards,* and *backwards.* It is necessary that it should be kept upwards, to bring the fragments on the same level, outwards, to preserve the proper length of the clavicle, keep the arm at its proper distance from the sternum, and preserve the pectoral space, and backwards, to bring the bones into the proper line in front. The first means to be shown of doing this, is the old and widely known—

APPARATUS OF DESSAULT.

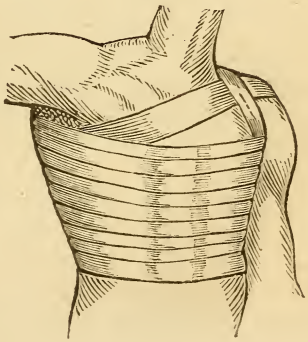
This is *Composed* of three single-headed rollers, eight yards long and two and a half inches wide, of a pad of the length of the humerus, and four inches thick at its base, made in the shape of a wedge by folding muslin on itself, so as to form a compress graduated from one end, as before shown, and then covered with a piece of muslin,—of a compress to go over the broken bone, of a short sling to support the fore-arm, and of a piece of muslin long enough and wide enough to surround the chest, arm, and bandage, and keep the whole in its place.

Fig. 146.



Application. — These being prepared, and the patient either seated on a chair or bench, without a back, or else standing, an assistant is to elevate the arm of the injured side, and carry it off at right angles to the body, whilst the surgeon places the pad in the axilla, the thick end upwards, where it is to be held by the assistant. The initial end of the first roller is

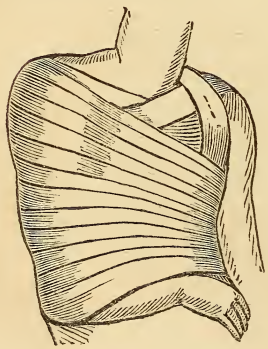
Fig. 147.



then placed on the middle of the pad, and two or three circular turns of the chest are made, when the roller is to be carried up over the front of the thorax, over the sound shoulder, under this arm-pit to make a semi-circular turn on the front of the chest, over the pad round on the back, over the sound shoulder, under the arm-pit, and then spirally around the chest. (Fig. 147.) The object of this roller is merely to fix the pad.

The surgeon then flexes the forearm on the arm, and bringing it down along the pad, presses its lower extremity forcibly against the side of the chest. This, by forcing the shoulder outwards, draws the clavicle to its original length; for the humerus being thus made a lever of the first kind, its upper end is drawn from the shoulder in proportion as the lower end is forced against the thorax. He at the same time directs its head upwards and backwards, and thus immediately reduces the fracture, an assistant holding it so until the next two bandages are applied. These are intended to keep the fracture reduced. With this view, place the commencement of the second roller in the axilla of the sound side, carry it across the breast, over the upper part *of the arm* of the injured side, and obliquely round the back to the axilla whence it started, and continue these turns down the arm to the

Fig. 148.



upper part of the forearm, drawing them gently at first, and gradually tightening them as they approach the elbow, so as to force it well inwards. (Fig. 148.)

The object of this roller is to carry the shoulder and head of the humerus outwards by pressing the elbow inwards. In order now to keep the shoulder upwards, the third roller is to be placed at the sound axilla, passed obliquely over the front of the chest to the fracture, where a compress is placed, then over this and down the back of the arm to the elbow, thence obliquely upwards to the front of the sound axilla, under this obliquely upwards over the back, over the fracture, down the front of the arm to the elbow, and thence obliquely to the back of the sound axilla, under this to its front part, over the chest and fractured bone, to run the same course, and end by circulars of the chest, which fix the whole. These turns form a kind of double triangle, one of which is before the breast, the other on the back, and are the only difficult ones to recollect. But when we remember that starting from the sound axilla, it is to go over the fracture down the arm to the elbow, *and from the elbow always to the axilla*, there will be no difficulty

Fig. 149.

in its application. After this, it remains only to support the *forearm* by the sling, and cover the whole apparatus by the piece of muslin before spoken of, in order to prevent the turns of the roller from slipping.

The principles upon which this bandage acts, namely, by converting the humerus into a lever of the first kind, by carrying its lower extremity forwards, inwards, and upwards, thus pushing the shoulder backwards, outwards, and upwards, renders it exceedingly well adapted to fractures of the clavicle. The pad placed in the axilla serves as the fulcrum; and one of the great advantages of the apparatus is, that it may be readily constructed. It is liable, however, to some objections; thus, for instance, the compression which it exerts about the chest, renders it ill adapted to females or patients of a delicate constitution, and is also very heating in warm weather, and requires to be taken off and reapplied at least every two or three days, from the circumstance of its becoming easily displaced by the movements of the patient, especially if it is in a child, and the pressure, too, of the axillary nerves and bloodvessels, from the too great tightness of the second roller, often causes great pain and inconvenience to the patient.

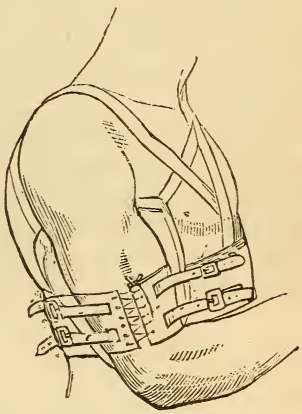
BARON BOYER'S BANDAGE FOR THE SAME.

Composed of a wedge-shaped pad for the axilla; — a belt of webbing or of linen, about five inches wide, and quilted to surround the trunk, closing at the ends by means of straps and buckles; a circular band for the arm, constructed of the same materials as the belt, and to lace in front: four

straps attached to this, two on each side, near the uniting edges, and to correspond with these, four buckles fastened upon the belt, two before and two behind the arm, complete it.

Application. — The pad is placed in the axilla, and its bands carried one before and the other behind the chest to the opposite shoulder, and tied: the belt is then passed round the body, beneath the pad, and a little above the bend of the elbow, and buckled posteriorly. Next, the circular band is laced upon the arm, and confined to the trunk by means of the straps and buckles of the same; a sling or band is sometimes added. While the elbow is thus fixed firmly to the side, the pad tends by its resistance to push the superior part of the arm outwards, and the elbow may be moved either forwards or backwards by merely tightening the anterior or posterior straps, and the shoulder thus carried in opposite directions.

Fig. 150.



This bandage, acting upon the same principles as that of Dessault, is preferable to the latter only from the circumstances of its not being liable to

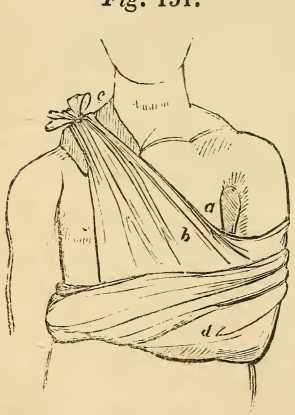
become displaced, and by its causing a more limited compression of the chest; this compression being capable of being regulated by means of the straps and buckles which unite the ends of the belt.

MAYOR'S HANDKERCHIEF BANDAGE FOR THE SAME.

Composed of two large handkerchiefs, or pieces of strong linen of the same form, one folded in triangle, the other in a broad cravat; — a cushion for the axilla; — and a soft pad for the opposite shoulder.

Application. — First, the cushion, *a*, is to be placed in the axilla, and the arm put into the proper position, with the forearm bent; the doubled edge of the handkerchief, *b*, folded triangularly, being made to envelope the elbow by its summit, while the angles support the hand; the posterior angle is then carried up under the axilla and behind the back to the opposite shoulder, upon which the pad or compress, *c*, is previously placed, and the anterior one brought up in front to meet it and be tied.

Fig. 151.



The second handkerchief, *d*, in cravat, serves to confine the elbow and

forearm more securely by being carried round the waist, and fastened upon the opposite side of the trunk.

Mayor modifies this bandage in the following manner when intended for fracture of the acromion: after the first handkerchief or sling is applied, some compresses should be placed upon the injured shoulder, and a few vertical turns of a roller passed round the shoulder and elbow, as in the third roller of Dessault; after which, the second handkerchief is to be applied as above; the cushion under the axilla should also be omitted, and a compress substituted, before applying the first handkerchief, between the elbow and side.

This mode of treating fracture of the clavicle answers very well as a provisional dressing, and better than the ordinary sling, but where the other means can be obtained, a more perfect cure will more certainly be accomplished.

APPARATUS OF DR. FOX.

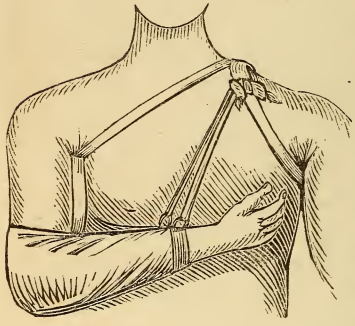
Composed of a stuffed collar, a small pad, an elbow-piece, and a little sling for the forearm.

The collar is made of a piece of four-inch muslin, sewed together on its sides, stuffed with cotton, and then joined at its ends. The pad is wedge-shaped, and like Dessault's, except that it is not so thick or so long, being merely intended to fill up the space between the arm and the side; two tapes are attached to its thick end, to fasten it to the collar. The elbow-piece is made of strong muslin or brown holland, like half of the sleeve of a coat, and embracing the elbow, mounts half way up the arm, and extends to near the

wrist. To its upper and lower or posterior ends, are attached two pieces of broad tape, long enough to reach across the back to the collar, and to its front are two loops to receive a tape for the front.

Application. — Place the collar on the sound shoulder, the pad in the injured axilla, and fix it there by carrying its tapes one in front of, the other behind the chest, to tie them on the collar. Flex the forearm, place the elbow-piece on it and the arm, and bring the arm against the pad. Fasten the posterior tapes to the collar behind; and running the tape or band through the loops near the wrist, tie the forearm well up to the collar in front. This reduces the fracture completely, and is all that is generally required.

Fig. 152.



Observations. — Of all the means recommended for the treatment of fracture of the clavicle, none are more simple or better to fulfil the indications than this of Dr. George Fox. Made in a few minutes of materials nearly always at hand, reducing the fracture, yet leaving it open to inspection; light and easy of application; producing no constriction of the chest, pressure on the mammæ or on the axillary vessels or nerves, it offers advantages that no other means possess; and Dr. Fox, by its introduction into practice, has caused

the *perfect cure* of very many cases, and saved the patients much unnecessary suffering and inconvenience. In the Pennsylvania Hospital it is the only means employed for the treatment of this injury, and repeated testimony has been given of its ability to produce perfect cures, it being a rare thing for a simple case of this fracture to go out of the house with any deformity save that which time cures, viz., the deposition of the provisional callus. From 1829 up to the year 1838, a period of nine years, seventy-five cases of fractured clavicle were treated in the house, of which, sixty-three were discharged cured, and twelve left the house while under treatment, the apparatus allowing of their walking about as usual.* In the subsequent years a large number of cases have also been treated with such success, that no one who has employed it ever resorts to any other means of treatment, except in special cases, where an additional bandage, as a posterior S, &c., may be added. Whenever there is any derangement of the fracture, it is only necessary to tighten the anterior or posterior tapes of the sling in order to remedy it. Its use is highly recommended, by a weight of surgical authorities, and by the simplicity and facility of its application. The effect produced on the bone by this apparatus, is well shown in the testimony of Dr. Norris, one of the surgeons of the hospital, who, in his notes to Liston's Surgery, says he was enabled to treat with entire success a forward dislocation of the sternal

* Wallace's Statistics of Fracture: Med. Examiner, for 1838.

end of the clavicle, after Dessault's bandage had been several times well applied, but without success. The difficulty of retaining the bone in its position here is so much more difficult than in cases of fracture, that it speaks highly for the powers of the apparatus.

FRACTURES OF THE SCAPULA,

Are generally accompanied by so much inflammation from the contusion, as to render the removal of this an object of greater importance, than the treatment of the fracture itself. Warm fomentations, by means of bags of chamomile flowers, or flannels wrung out of hot water, leeches, &c., must therefore be first employed, after which we may employ the pad, and first and second roller of Dessault — Fox's Apparatus, or the bandage of Velpeau, which, as the author says, is applicable to acromio-clavicular luxations, to fractures of the acromion or other points of the scapula, to fractures of the neck of the humerus, as well as to fractures of the clavicle; but from numerous opportunities of witnessing the result of its application to the latter injury in his own wards, it seems to be not as perfect in its cures as the means before spoken of. To the other cases it is exceedingly well adapted, and is applied as follows: —

VELPEAU'S BANDAGE.

Application. — Make the patient embrace the sound shoulder with the hand of the injured side, placing a compress or piece of muslin between the side of the chest and the injured arm, in order to prevent excoriation. Then place the initial extremity of a roller ten yards long, and two and a

half inches wide, under or behind the axilla of the sound side, and conduct it up over the back, over the injured clavicle, down on the front and *outside* of the arm, under the *outside* of the elbow, up and over the chest to the sound axilla. Make two turns like this, and on again reaching the axilla, pass circularly around the chest to the same axilla; then make a turn over the clavicle and arm — then a circular, and so on till it reaches the upper part of the forearm, as seen in the figure. By means of this bandage, especially when wet with starch or dextrine, the arm is supported in a firm cap, which will last for weeks without changing; but where these articles are not used, several pins must be placed at the different turns in order to secure them.

Fig. 153.

FRACTURE OF THE NECK OF THE HUMERUS.

Boyer's Bandage.

Composed of two rollers, two and a half inches wide; — three strong pasteboard splints, between two and three inches broad, and the length of the arm; — a pad, four inches thick at one end,

terminating at the other in a narrow point, and long enough to reach from the axilla to the elbow; and thus serve as an inside splint, and fulcrum for the reduction of the fracture, the thick end being in the axilla, if the lower fragment is drawn inwards, and the reverse, if the upper one is thus drawn. Lastly: a sling to support the *forearm.*

Application. — The fracture being reduced, and maintained by the assistants, the surgeon fixes the initial extremity of one of the rollers, at the upper part of the wrist by two or three circulars, and winds it round and up the arm as in the Spiral of the Upper Extremity; taking care, however, when he arrives at the upper part of the limb, to make several turns around the fracture so as to bind it firmly; from hence he carries the head of the roller twice round the opposite axilla, and confides it to one of the assistants, who retains it upon the top of the shoulder of the injured side. The first splint being then placed in front, reaches from the bend of the arm as high as the acromion; the second, on the outside, from the external condyle to the same height; and the third, from the olecranon behind to the margin of the axilla: these are given to another assistant to hold; which he does by applying his hands near the bend of the arm and shoulder, in order not to obstruct the application of the bandage.

The surgeon now takes the same roller, or a new one, and fixes these splints to the arm by moderately tight spiral turns, and pins the end on the shoulder, and while the assistants still keep up the extension, he places the cushion between the arm and trunk, taking care to put that end up-

wards, which the deformity calls for: lastly, bringing the arm against the trunk, he confines it there, by means of the second roller, or turns of the same one applied in horizontal circulars around the body. The turns of the last roller should be rather tight below and slack above, if the fracture be displaced inward; but if outward, they should be slack below and tight above, in order to act on the extremities of the lever, formed by the humerus. The *forearm* is to be sustained by a sling, which should not go under the elbow, as it might then cause shortening, but merely support the band.

BOYER'S BANDAGE FOR FRACTURE OF THE BODY OF THE HUMERUS.

Composed of a single-headed roller, eight or nine yards long and two and a half inches wide; — a compress of soft linen rag; — four splints, not quite so long as the arm, nor so broad as to touch each other when applied; and lastly, some lint or charpie.

Application. — The surgeon, placing himself on the outer side of the limb, commences by passing a roller, carefully, round the hand and forearm to make a spiral of the limb, and prevent œdema of these parts; fixing its initial end by a few circulars made above the wrist, and filling the hollow of the hand with cotton. His next care is to reduce the fracture; and being well assured that the arm has resumed its natural form and length, he continues the turns of the roller onward from the elbow to the upper part of the limb, applying the compress over the seat of the fracture, and filling

up with cotton or some other soft material, the depression which corresponds to the insertion of the deltoid muscle, in order to effect a uniform pressure. That done, he confides the head of the roller to an assistant, and places the splints, well padded, along the arm, at the extremities of its transverse and antero-posterior diameters. Lastly, the assistant giving up the roller to the surgeon, and laying hold of the splints near the bend of the elbow, the latter proceeds to cover them in by spiral turns, and fastens the end of the bandage with a pin.

Observations. — These constitute the usual dressings for the accidents mentioned. But if in fractures of the shaft of the bone the arm and forearm are not well secured to the body, or if the patient becomes restless, more or less motion will be produced at the elbow-joint, which must, of course, derange the lower fragment, whilst the slipping of the turns of the spiral bandage on the forearm, will necessitate its almost daily reapplication. To obviate this, the use of an angular splint, such as will be hereafter described, well padded and extending from the axilla to the ends of the fingers on the inside of the arm, is usually resorted to in the Hospital, the *three* short splints above the elbow being also applied, as in Boyer's method. That is, the arm is first fastened to the angular splint by the ordinary spiral bandage, and then the short straight splints are applied, as before seen. During the cure, the angle of the splint should be occasionally changed in order to prevent stiffness of the elbow-joint. It must be recollected, however, that this dressing is only applicable to

fractures below the insertion of the deltoid; when higher up, it will not answer.

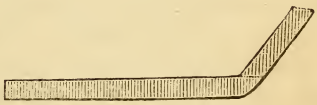
FRACTURE OF THE CONDYLE.

Physick's Method.

The position of the condyles to the elbow-joint, renders the treatment of a fracture of them a matter of great importance, as, without proper attention, the inflammation may extend to the joint, produce anchylosis, and deprive the patient of the use of the limb. When the fracture is simple, the best method of treating it is that proposed by the *late Dr. Physick.*

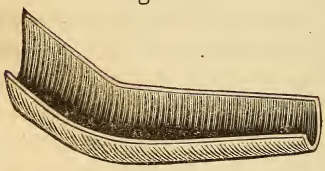
The forearm being flexed on the arm so as to relax the flexor and extensor muscles, apply a bandage from the fingers up to the shoulder by spiral reversed turns, making a figure of S around the elbow. Then prepare two angular splints like the cut, and covering them well with cotton, apply one on the inside, and the other on the outside of the arm, from the shoulder down to the fingers, and confine them by another spiral bandage applied exactly like the Spiral of the Upper Extremity. Then bring the forearm across the chest, and place it in a sling, the palm of the hand being next to the front of the chest, and the thumb pointing upwards to the chin. In pursuing this treatment, attention must be paid to the state of the internal condyle, which, unless the splint is well padded, is very apt to ulcerate from the pressure. The

Fig. 154.



angle, also, of the splint should be changed every third day during the treatment, after the first ten days, in order to prevent anything like anchylosis. If the fracture is complicated with contusion of the joint, or if it is compound, a better plan will be found in the use of a carved angular splint like the cut, in which the arm may lie, loosely confined by a few strips of Scultet's bandage, while leeches, cold washes, &c., may be applied to the part, to combat the inflammation; or it may be simply flexed and laid on a pillow till this is reduced, after which it is to be treated as a simple fracture. In order to make this carved splint, or rather in order to make a carved splint for any of the limbs, pursue the following plan. Lay the limb on a piece of stiff paper or soft wood, and mark an outline of its shape with a pencil, tracing accurately its angle, its prominences, &c., by running the pencil over its surface. Then seeing that the wood is thick enough to allow the limb to sink in it to the depth required, scoop it out in the lines of the pencil, and shave it off on the outside with a spoke-shaver or gouge, so as to reduce its thickness and make it correspond externally and internally with the roundness of the limb. A piece of linen or muslin is then to be pasted over the outside to prevent its splitting from moisture, and the inside covered in the same way with soft buckskin to prevent the chafing of the skin.

Fig. 155.



These splints are of great utility in the treat-

ment of all injuries in the neighbourhood of joints, and so simple that any one of the least mechanical ingenuity can make one that will answer the purpose very well, though the aid of a professed carver is desirable when a very light and perfect splint is required.

FRACTURES OF THE FOREARM.

Fracture of one or both bones of the forearm are dressed exactly in the same way, with the exception of fractures of the lower end of the radius, and of the olecranon or upper extremity of the ulna. The fracture being reduced by means of the extension at the wrist and counter-extension at the elbow, and the muscles well kneaded, in order to preserve the interosseus space, we can best dress it according to the plan of the hospital.

This consists of two straight splints, long enough to extend from the bend of the arm beyond the fingers, half an inch *wider* than the forearm, and well padded with cotton, which is to be confined to them by a roller, and which should be thickest on their middle, so as to act as a pyramidal compress on the interosseous space. One of these splints should now be applied on the front, the other on the back of the forearm, whilst it is in a state between supination and pronation; or, in other words, while the bones are perfectly parallel, and confined there by a roller only moderately tight at first, so as to guard against swelling. After the lapse of a week, the roller may be drawn more firmly, so as to cause the padding of the splints to act on the interosseous space; but we must be careful that it is not too tight. The case of amputation of the

arm consequent on the mal-application of the roller in a simple fracture of the radius, as before mentioned, should caution us against the use of too much traction in the application of the roller, especially at first.

FRACTURE OF THE LOWER END OF THE RADIUS.

Barton's Method.

This fracture often similates a sub-dislocation of the wrist, owing to the falling of the hand, as seen in the cut, and so frequent is it, that eight out of

Fig. 156.

ten supposed sub-dislocations of the wrist will probably be found to be fractures of this kind. For the best treatment of it, we are indebted to Dr. J. Rhea Barton. His apparatus is —

Composed of two compresses, about three inches by two, or else two and a half inches square, and graduated from one end, — two splints prepared as in fracture of both bones of the forearm, and a two and a half inch roller.

Application. — Place one of the compresses on the front of the wrist, with its thick end downwards, and about one-eighth of an inch above the articulating end of the radius; place the other on the back of the wrist, with its thick end upwards,

so that it may be on a line with the upper row of the bones of the carpus, or on a line with the end of the first compress, so that one may begin where the other ends, though on opposite sides of the wrist. Fasten these by a few turns of a roller loosely applied, then place the two splints in their position, one on the front, the other on the back of the arm, extending from beyond the fingers up to the elbow, and bind them there by the spiral bandage, as in fracture of both bones. After a few days the tightness of the bandage may be increased; and motion made to a slight extent in the joint to prevent anchylosis. If instead of the bulging on the back of the hand, as generally seen, it should be on its front, we have only to change the relative position of the compresses, and then pursue the same plan.

FRACTURE OF THE METACARPAL BONES,

Is generally caused by heavy weights falling on them, and producing such a degree of contusion as to require our closest attention to combat the inflammation. In this case, we should employ a splint carved out to fit the arm and hand, placing a small mass of cotton under its palm, so as to preserve the convexity of the hand. Allow the limb to be thus open in the splint, till by leeches, cold washes, &c., we have reduced the inflammation. If, however, the fracture is produced by a fall on the hand, we shall most frequently find it in the bone of the little finger, this being one extremity of the arch, and therefore most exposed to the shock. To dress this, place a mass of cotton in the hollow of the hand, as before done, and bandage the limb to

a splint with a broad palmette or hand-piece. The splint should extend from the ends of the fingers up to near the elbow.

FRACTURES OF THE PHALANGES.

If simple, are first covered in with a spiral bandage of the finger, and then kept in their position by means of four small splints of binder's board; those on the front and back of the finger, reaching from its extremity as high as the wrist, and the two lateral ones extending only the length of the finger. These are to be padded with cotton, and confined by a second spiral of the fingers, the roller in each case being under an inch in its width. Attention should be especially given to the state of the joints in these fractures, a stiff finger being a serious inconvenience.

FRACTURE OF THE OLECRANON.

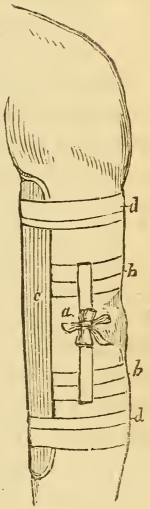
In this injury the upper fragment is drawn up by the action of the triceps. All the means of treatment have therefore the same object, viz., the bringing it down, or the placing of the two fragments as closely in contact as possible, in order to diminish the amount of ligamentous union. When from excoriation or other accidents one method is not available, another may be substituted, as all have some points which recommend them to particular cases.

SIR ASTLEY COOPER'S APPARATUS,

Is *Composed* of two strips of muslin, each about half a yard long; — two short rollers; and another roller of the ordinary size; — and a splint made

of split wood, covered with cloth, and of a sufficient length to extend from the margin of the axilla about half way down the forearm.

Fig. 157.



Application. — The patient's arm being put into extension, and the upper fragment pressed down until it touches the body of the ulna, a strip of linen is to be applied above and below the joint, and one of the short rollers passed round the limb above, and the other below the olecranon, to secure them, as at *b b*. The extremities of each slip are then to be reflected and tied together, as at *a*, which draws the rollers nearer to each other, and places the fragments of the olecranon in the closest apposition possible. Lastly, the split splint, *c*. well padded, is applied along the front of the arm, and secured by a bandage, *d d*, which is to be frequently wetted with an evaporating lotion.

M. DESSAULT'S APPARATUS FOR THE SAME,

Is *Composed* of a strong pasteboard splint, long enough to cover a part of the arm and forearm, and shaped so as to accommodate itself to the bend of the elbow, when the arm is in a demiflexed position; — a roller five or six yards long and two and a half inches wide; — and some compresses or lint.

Application. — The limb being maintained by two assistants in demiflexion, the surgeon proceeds to cover in the hand and forearm with the roller; as he approaches the elbow an assistant draws the skin, which is here usually wrinkled, gently upward, to prevent it from introducing itself between the fragments: the surgeon now pushes down the fractured extremity of the olecranon, in order to place it in exact contact with the ulna, and confines it in this situation, by means of a few turns of the roller, carried round the joint in form of a figure of 8, as in the bandage for phlebotomy: the elbow being at length covered, he carries the roller spirally as far as the axilla, and applies the curved splint well padded with the lint or compresses, along the front of the arm and forearm, fixing it by a succession of oblique turns of the remainder of the roller, carried down to the wrist.

THE HOSPITAL APPARATUS,

Is *Composed* of two, two and a half inch rollers, a splint to extend from the middle of the arm to below the middle of the forearm, and of the width of the arm, and some cotton or tow to fill up the hollow at the bend of the arm.

Application. — Extend the forearm on the arm, and bring down the upper fragment, and whilst it is held by an assistant, apply the ordinary Spiral of the Upper Extremity from the fingers up to the shoulder, making figure of 8 turns around the elbow so as to keep the fragments in apposition, applying it firmly around the *arm*, to prevent the action of the triceps. Then apply the tow to the bend of the arm, and bind the padded splint on its

front by a second spiral bandage. After ten or twelve days a slight degree of flexion should be made at the elbow and gradually increased to prevent stiffness.

BOYER'S METHOD.

According to this distinguished surgeon the indications are to keep the fragments as closely as possible in apposition, without uselessly fatiguing the muscles by complete and constant extension of the forearm, and also, by rest, to favour the formation of the intermediate substance without allowing the ligaments of the joint to loose their natural flexibility.

In order to do this, he flexes the forearm slightly on the arm so as to make an obtuse angle with it, and then applies an ordinary spiral bandage from the fingers to the elbow. The fragment being then drawn down, is confined by means of a narrow strip or long compress which is placed behind it and fastened by crossing its ends in a figure of 8 around the forearm. The bandage is now continued over this compress so as to make several figures of 8, and then carried by spiral turns up to the shoulder so as to firmly compress the triceps. After the twentieth day he causes motion at the joint, and at the forty-fifth day the cure is complete, the union being then as solid as it ever will be. Should there be much swelling or pain, we should not apply the bandage or attempt the reduction of the fracture, but allow the limb to lie loosely on a pillow, and combat, by topical applications, the inflammation. If it does not disappear by the twentieth day, the case is to be left

to nature, a number of instances having shown that even when thus left, it can preserve all its strength and freedom of movement.

THE CARPO-OLECRANON HANDKERCHIEF OF M. MAYOR,

Has been already mentioned. It will answer very well in many cases.

THE UNITING BANDAGE OF GERDY,

For transverse wounds, and for fractured patella, is also applicable here. When the fracture is compound, or complicated with severe contusion, it has been found useful in the hospital to place the limb in the carved angular splint before spoken of, and confine it by a few strips of Scultet's bandage, employing leeches, cold washes, &c., as in compound fractures of the condyles of the humerus.

FRACTURE OF THE CORONOID PROCESS OF THE ULNA,

Resembles a dislocation of the bones of the forearm backwards. By pulling the forearm, and at the same time flexing it, the dislocation is reduced, but will return immediately when this force is removed. In order to prevent this, flex the forearm and bind a padded angular splint along its inside, so as to keep it flexed for several weeks; the action of the brachialis internus being prevented by the turns at the elbow. This accident is a very rare one, Dr. Physick having seen but one case which he thus treated.

FRACTURES OF THE LOWER EXTREMITY.

In no case requiring surgical *attention*, has there been as many proposed plans of treatment as in the fractures of which we are now speaking. Almost every year, and from almost every section of the country, have we accounts of some new modification, or some decided improvement in their apparatus, which, in the opinion of the inventor, and from the decided testimony of *one* or *two perfectly cured* cases, must supplant everything heretofore known, when, perhaps, the great and improved modification consists only in the substitution of narrow strips for broad bands, or in the difference of a buckle, or the peculiar shape of a hinge. To refer, then, to these, would be as useless as uninteresting; and we shall, therefore, present only the more original plans, premising a few remarks on the duties of the surgeon in the preparation of the means requisite for their treatment.

When called to a fracture, or even a supposed fracture of the lower extremity, our first duty should be to consider in what way the patient may be most readily moved, and prepared for his dressing, and then how that dressing itself is to be obtained.

First. How are we to prepare for the removal and dressing of the patient.

In cases of this kind, we most frequently find the patient laying on a couch or settee, and encumbered with his ordinary dress, and we know that for the proper treatment of his case, perfect rest is almost absolutely essential. Our thoughts, therefore, naturally turn to his place of rest during

the treatment. An ordinary bedstead, provided it is low, narrow, with a low head-board, and without a foot-board, may readily be adapted to our wishes, or made into what is called a *Fracture Bed*, by first drawing the sacking-bottom as tightly and drum-like as possible ; or if slats can be had, by placing them in their position. Cut, then, in the centre of either, a hole large enough to admit a pot, and nail on the underside of the bedstead, at a distance to correspond with the width of the pot, two strips grooved or ploughed like the strips in which an ordinary counter-draw runs, so that they may receive the rim of the pot, and allow of its sliding in and out under the patient. If a number of these bedsteads are required, as in a hospital, it will be found most useful and cleanly to have them made of iron, as they are then more readily preserved from bugs, &c.

After the bedstead, we should prepare a *hair* or firm and even mattrass to fit the bedstead, by cutting out a piece to correspond with the hole in the frame, and sew the cut edges of its ticking together, after having well arranged the stuffing, so that the edges of the hole may not be hard or knotted. We then place over this a sheet with a similar hole in its centre, and arrange on it the preliminary portions of the apparatus to be used, after which we may turn our attention to the patient. Having carefully removed his clothes, &c., we should prepare to remove him to the bed. To do this properly, see that the open side of the settee corresponds with the side of the bed, and the head of the patient with its head, especially if his room is narrow; otherwise we shall be compelled to

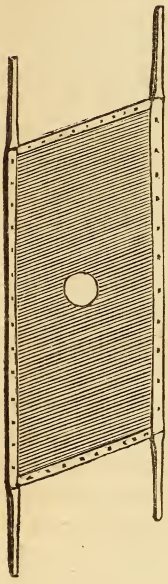
carry the settee out of it, and perhaps down stairs, in order to turn it, as we have occasionally seen done, and thus give unnecessary pain and trouble. We next procure three assistants, and having informed them of their duties, place one at each shoulder of the patient, so as to face each other, and the third at the pelvis on the sound side, while the surgeon himself takes charge of the injured limb, and directs the assistants at the shoulders to pass one of their arms under the patient's neck and shoulders. Let them now slide their other hands under his buttock, so as to clasp each other's fingers in what is known as the sailor's grip, or, in other words, grasp hands, by making the palmar side of their fingers touch.

The third assistant, holding the sound limb, the surgeon places one hand under the seat of fracture, the other under the calf, if in the femur, and, at the word, directs the assistants to lift and carry the patient down to the foot of the settee, so as to get free from it, and then, passing one on each side of the *narrow* bedstead, to place their burthen so that the lower part of the buttocks may correspond with the upper edge of the hole in the mattress, when the dressings may be readily applied. If, instead of a fractured thigh, it is a fractured leg, the arrangements should be the same, except that the surgeon should grasp the leg with both hands, one being at the knee, and the other just below the seat of fracture, or at the ankle.

These directions, though minute, are absolutely necessary to prevent the suffering of the patient, and the awkwardness produced by a want of attention to them, as assistants or inconsiderate surgeons are very apt so to place themselves, that

on moving, they come directly between the bed and the patient, which necessitates their lying down or crawling across the bed in order to get out of the way.

Fig. 158.



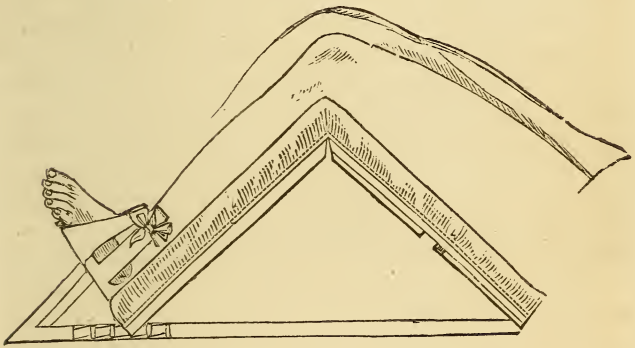
But where it is difficult to prepare the bed as thus directed, a very excellent and simple substitute will be found in a frame made of sacking or strong cloth, nailed on two narrow strips the length of the bed, and joined by two transverse ones, as in the figure. This is to be placed on an ordinary firm mattress, and a sheet, with a similar hole being placed over it, the patient will lie as on an ordinary bed till he requires a stool, when assistants at the head and foot of the bed, may raise the frame like an ordinary hand-barrow, and by placing its ends on four heavy chairs, readily air the bed, or even remove it, and of course can also easily pass a pan under the frame to receive the discharges.

Having now completed these arrangements, we should proceed to the

Preparation and application of the apparatus. This will, of course, depend on the injury. In fracture of the femur below the neck, the extended position, as recommended by the French surgeons, is almost the only one employed here, and the apparatus of Dessault, as modified by Drs. Physick and Hutchinson; the apparatus of Boyer, modified

by Hartshorne, or that of Hagerdon modified by Prof. Gibson, are almost the only ones employed, though we occasionally see the plan of Amesbury, and of Prof. Nathan R. Smith, in use, in special cases. In fractures of the neck of the femur, especially in old persons, it is generally sufficient to lay the limb bent on itself, on a double-inclined

Fig. 159.



plane, as that of Sir Charles Bell, or we may use the method of Dupuytren, in which a double-inclined plane is formed by cushions of different sizes covered by a common sheet.

DUPUYTREN'S PLANE.

Application. — Three or four cushions, decreasing in size from below upward, are placed under the ham; the rest of the cushions are so disposed as to form a double-inclined plane. The thigh is made to repose upon that plane which corresponds to it, while the leg in a state of flexion rests upon the other; and the limb is maintained in this position

by means of a sheet folded like a cravat, the central part of which should embrace the foot, while the extremities are attached to the sides of the bed.

Simple, however, as this is, the plan usually pursued with us is more so, and answers equally as well. This consists in doubling an ordinary pillow on itself, and placing it under the ham and leg, thus making a plane of the simplest kind, and giving, by the addition of a band to fix the foot, all that is requisite for the treatment of this injury.

But in fractures of the shaft of the bone, the extended position being preferable to the bent one, the treatment is very different. Here, owing to the shortening produced by the muscles, we must employ some means of making extension and counter-extension, as it is usually termed; though not so in reality, as the means of extension should always be the hands of the surgeon, and the bands be used only to *preserve* the extension when he has made it.

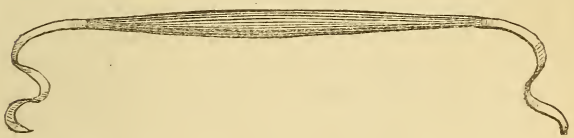
To do this, various bands have been employed, but it matters little of what they are made, provided they are flexible, soft, and porous, especially the latter, so as not to unduly promote the insensible perspiration, and thus favour excoriation. But as these qualities are seldom found united, most of the means of preserving extension are made of two substances, the best of which are brown holland linen, and buckskin. These may be employed either as in the gaiter of Dr. Physick, or the band of Dr. Coates.

DR. COATES'S BAND FOR PRESERVING EXTENSION.

This is made of a piece of brown holland,

slightly biassed, but leaving the central threads continuous throughout, from fifteen to eighteen inches long, if designed for an adult, two inches wide in the middle and narrowing on each side, rapidly at first, then slowly, towards the extremities, which are an inch in width. This is to be lined throughout nearly its whole length with thick buckskin, a very little wider than the linen, the latter being simply basted to the former by stitches which dip but half way through the skin, in order that they may not produce irritation. Two pieces of tape, each an inch wide, are sewed securely to the ends of this band, so as to make it long enough to go over the lower end of the splint. In apply-

Fig. 160.



ing this, place the centre of it over the tendo-Achilles, and bring the ends round above the malleoli to the front of the ankle, cross them on the top of the instep, and carrying them down, knot them beneath the instep a short distance from the sole of the foot, when the tapes are to be carried over the end of the splint, and tied.

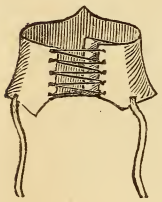
Where this band cannot be readily obtained, a common handkerchief folded into a similar shape and applied like this band, answers quite as well. But in some cases, owing to the irritability of the patient, and the extension being made by the band instead of the hands of the surgeon, or owing to a

want of attention to the smoothness of the band, excoriations will happen. It is desirable, therefore, to be able, by changing the means of preserving extension, to bring the pressure to bear on different points, and we may resort to the following:

PHYSICK'S GAITER.

Composition. — This is made of buckskin and kid, of cloth and buckskin, or hollands and buckskin, but in either case the buckskin should go next to the skin, as it is the softest, most porous, and flexible of all these substances. Cut out of either of these substances two pieces of the shape of the figure, and make it eleven or twelve inches long at its greatest length, and eight inches at its least for an adult, and about four inches in its other diameter. Work eyelet holes in the ends to receive the cord which laces it to the ankle, and sew a piece of buckskin on the inside of one end, so that it may come under the lacing when the gaiter is applied, and prevent the cord from pressing on the skin: lastly, sew on two broad tapes or bands of about three-fourths of a yard long in order to pass to the end of the splint.

Fig. 161.



In applying this, place a layer of carded cotton on the surface which is to be next the skin, and lace the gaiter *smoothly* round the ankle from an inch above the malleoli down on to the front of the instep. Should the use of this cause pain, we should at once look to it, and if a slight change in its arrangement does not relieve it, or should it

produce excoriation, use some other band, as the handkerchief of Dr. Barton, as before treated of, under the handkerchief system.

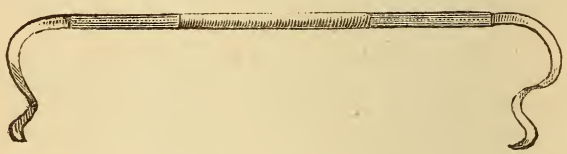
With these means of preserving extension, we shall have all that is necessary. Let us now look to the means of counteracting them, or the means of *counter-extension.* The padded band of Dessault or Boyer, the bandage doubled several times on its length, or the use of a thick cravat, may all be objected to, as frequently causing excoriation of the part; we shall, therefore, confine ourselves to the consideration of *Coates's Perineal Band,* which is decidedly the most perfect means that we have.

COATES'S PERINEAL BAND.

This is made of a piece of brown holland, long enough to go round the perineum in the line of the groin, and reach above the crista ilii both before and behind. For an adult it should be three inches wide. Double it in its width, and sew the edges firmly together, leaving one end open and closing the other, and turn it inside out like a bag. Then pour in bran or chaff sufficient to fill it lightly, and quilt one-third of the closed extremity so as to flatten it to the thickness of half an inch. Pour in a little more bran, and stuff it firmly till the central third is quite round and firm; and closing the open end, quilt the terminal one as before, attaching to each end two broad tapes of three-fourths of a yard long. Next take a piece of soft buckskin about three inches and a half wide and about half as long as the band, double it, and stitch the edges together so as to form a tube with the

ends open, so that when the band is applied, it may be slipped over and cover that part of it which is to press on the pubis, perineum, and tuberosity of the ischium; and the seam being turned from these parts, secure it firmly to the band by a few stitches. When soiled, this may of course be easily changed. The buckskin is a great improvement to the ordinary band; and, according to the experience of the inventor, and from what we have ourselves seen, seldom or ever produces irritation.

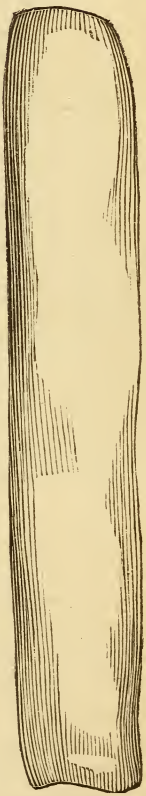
Fig. 162.



In connection with these bands, and before describing what remains of the apparatus for fractures of the femur, let us glance at the remarks of Dr. Coates in relation to the delay attending our preparations. "There is scarcely ever," says he, "a necessity for rapid action in a case of fractured leg or thigh, but it would be wrong to leave the patient to undergo the gradual shortening of the limb from continual muscular action, while the surgeon rides off for his splints, or while he superintends their preparation in the shop of some carpenter who never saw what he is required to make. Let him, therefore, secure the limb by temporary means, and save his patient the exquisite pain of involuntary motions, the irritation from the pressure of the fragments upon lacerated

muscles, and the increased force required to overcome their contraction. Let the patient, therefore, be placed on the bed diagonally, and with extending and counter-extending bands made of towels, handkerchiefs, &c., employ one head-post and the opposite foot-post for securing him. The surgeon can then proceed coolly and leisurely for his apparatus, certain that his patient suffers but little, and that scarce anything is lost by delay."

Fig. 163.



We now proceed to the *Junct-Bags*, or the stuffed bags intended to prevent the pressure of the splints against the sides of the limb. These are made of muslin of the length of the limb, or rather, long enough to extend on its outside from the pelvis to the external malleolus, and on its inside, from the perineum to a point a little above the internal one. One end of this being sewed up, it is to be filled with bran or chaff till moderately full, and then the open end being closed, it will form a cushion of the width of the splint, and like the figure.

THE SPLINT CLOTH,

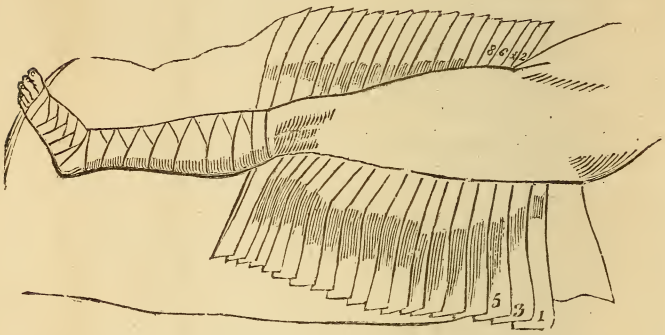
Is a piece of muslin, a yard and a half long, one yard wide, and intended to keep the splints to-

gether, and form a kind of box, by being wrapt around them.

THE BANDAGE OF SCULTETUS,

Which is also sometimes necessary, is made of strips of muslin about three inches wide, and of a length gradually decreasing from the first strip.

Fig. 164.



This should be long enough to go once and a third round the upper part of the limb, and each subsequent strip should be one-half inch shorter. To prepare and apply them, lay down the longest strip on a pillow or board, so that the whole may readily be placed under the limb without being deranged, and place each strip so that it shall cover only one-third of the preceding one. Then placing the limb on these (*obliquely* in regard to their length, in order to favour their application), commence at the lowest part of the limb, and gradually ascend, drawing each strip moderately tight. When it is necessary to change one or more of the strips, undo the bandage, and attaching the

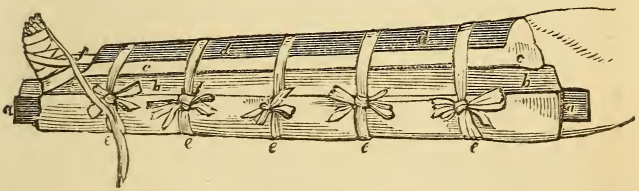
fresh band to the soiled one, draw the latter out, and thus place the fresh one in its place without deranging the limb.

THE EIGHTEEN-TAILED BANDAGE,

Is *Composed* of a strip, three inches wide and as long as the limb, to which are stitched cross-wise, eighteen or more strips of an equal width, and sufficiently long to make a turn and a half about the limb, and cover in each other by about two-thirds, each having a slight degree of obliquity relative to the longitudinal piece. It was formerly applied like the bandage of Scultetus, but has been supplanted by it, as its strips could not be changed, owing to their peculiar construction.

The *Splints* for fractured femur differ in their form. Those of *Dessault* consist of one for the outside of the limb, long enough to reach from the spine of the ilium to four inches beyond the foot,

Fig. 165.



and of another extending from the perineum to the sole of the foot, both of them of the width of the limb. In the upper part of the outside one are holes to receive the counter-extending band, and at its lower end one for the extending band. To these were added a third splint, junct bags, Scultet's bandage, &c., as shown in the cut. (Fig. 165.)

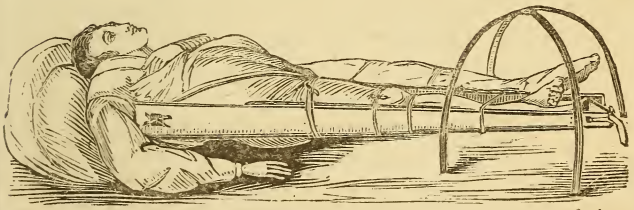
DR. PHYSICK'S SPLINTS,

Are like these, except in the addition to the length of the outer one, by which the end went nearer the axilla, thus making the counter-extension more in the line of the body, and preventing any inclination to that side, whilst the addition of a block by Dr. Hutchinson, made the direction of the extending band also more in the line of the limb. To these were added some means of extension, counter-extension, Scultet's bandage, &c., as before spoken of. With slight modifications, this is the apparatus now employed in the Pennsylvania Hospital, and, as the experience of the large number of cases there treated, proves it to be all that is requisite for simple fracture of the shaft of the bone, it is strongly recommended as the most simple of our means of treatment.

Application. — Having arranged the patient, the bed, and the apparatus, as before shown, we place the patient on the fracture-bed, with his buttocks corresponding to the hole, and the counter-extending band of Coates, in its place. We then roll the splints in the splint-cloth on the floor, so that the splints may be of the proper distance apart, and give them to an assistant. The *means of preserving extension* being placed on the foot, we seize the limb above the ankle with both hands, and draw it gradually and steadily down till it is nearly the length of the sound limb, or till the spasmodic contraction of the muscles is overcome. This may require five or twenty-five minutes, when the splints and splint-cloth may be slid under and up the

sides of the limb by the assistant. The splints now lying on the bed, the junct-bags are placed on them, and their stuffing made to correspond with the prominences and depressions of the limb, when the *outer* splint may be pressed to its side, the junct-bag being in position, and the counter-extending tapes tied on its outside through the holes at the upper part. Then the extending tapes being passed over the block, and one of them through the hole at its lower end, both are to be tied on the extremity of the splint so as to secure the extension *gained by the hands* of the surgeon, who keeps up this extension till the bands are fixed, and the outer splint in its place. The junct-bag being then arranged on the inner splint, and it, turned against the side of the limb, three

Fig. 166.



pieces of roller are passed under the hollow of the knee and slid up and down the limb to their position, and tied on the side of the splints. Looking now to see that the patient's body is perfectly straight in regard to his limbs, which may be told by seeing that the two anterior superior spinous processes are on the same level, measure from them to the internal malleolus of each limb, to see what is the difference in their lengths. Then placing a hoop, bent as in the figure, over the toes

to keep off the weight of the bed-clothes, the dressing is completed. If, after two or three days, or even ten days, we find there is still shortening of the limb, make the extension *with the hands* as before, and daily drawing on the limb thus, pull it down and tighten the bands, till it is of the same length, or as much so as possible, a difference of an eighth of an inch not being perceptible in the gait. Generally the reduction is completed at the second visit, but we caution the young surgeon against believing that the fractured femur will in all cases, or even in the majority of them, be *perfectly* of the length of the sound one. In favourable cases the difference will scarcely be perceptible ; but if attention is not paid to the position of the spinous processes, we may readily deceive ourselves, and prove the limb as long, or *even longer*, than the sound one, a point of which some have boasted when speaking of the success of their treatment. If excoriation of the heel is likely to occur, the placing of a piece of kid spread with soap cerate on the part affected, or the substitution of some other means of preserving our extension so as to vary the point of pressure of the band, should be resorted to. In this method, it is seen that the bandage of Scultetus, or other bandages, or short splints on the front or back of the thigh, are dispensed with, no advantage being derived from their use in the majority of cases, whilst we can, owing to their absence, examine the state of the fracture, apply cold washes to combat any inflammatory action, and yet not derange the limb by their application.

BARON BOYER'S APPARATUS,

Is *Composed* of a splint, of particular construction for extending the limb ; — a foot-board ; — a padded belt or perineal band, which is buckled round the upper part of the thigh ; — two common flat splints of the length of the limb, one for the anterior and the other for the internal part of the thigh; — and some junct-bags, tapes, and wadding.

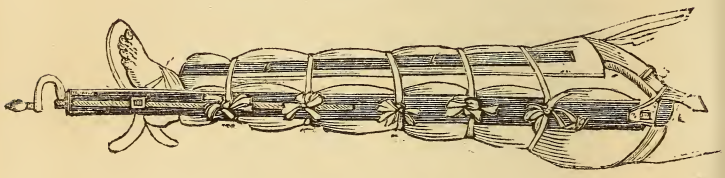
The outside splint is about four feet long and three inches wide. Along half its length runs a groove, about half an inch broad, the extremity of which is covered with iron ; to this groove a screw is adapted, which occupies its whole length, one end of it being supported against the plate of iron covering the extremity of the groove, and the other made to fit a handle by means of which it is to be turned. On the inside of this splint a contrivance for holding up the foot-piece is fastened to the screw. The upper part of the splint is received in a sort of pouch or bag adapted to the external side of the perineal or thigh belt. The sole piece, or foot-board, which has two branches at its inferior part, is made of iron, and covered with soft leather. This is connected by means of a mechanical contrivance, as just mentioned, with the screw. To that part of the sole which is near the heel, is attached a broad piece of soft leather, which being split on each side into two straps, serves for fixing the sole to the foot.

The perineal band is of strong leather, covered with buckskin, and well stuffed with wool : near the place where its two ends are buckled together

on the limb, a little leather pocket is sewed for receiving the upper end of the external splint.

Application. — The patient being properly disposed upon the bed, a piece of linen, of the length of the limb and about three-quarters of a yard broad, called *porte-attelle*, or splint-cloth, is passed under the limb, lying upon five tapes. In the next place, the perineal band is applied, the surgeon having previously surrounded the upper part of the limb obliquely with a cushion of wadding, four fingers' breadth wide, and the length of the thigh-belt, or with the junct-bag, in order to moderate the pressure of the latter, and render it more supportable. The hollows of the sole of the foot and lower part of the leg are filled up with wadding or tow, and the foot-piece, is fast-

Fig. 167.



ened to the former by means of the soft leather straps attached to its under surface, which pass round the lower part of the leg: should, however, these straps appear insufficient to fix the iron sole to the foot firmly, an extra band may be applied in the same manner, of calico or linen.

That done, the surgeon proceeds to the reduction of the fracture, and afterwards adapting the upper extremity of the splint to the pouch of the

perineal band, the foot-support being connected with the splint, the cushions, and the anterior and internal splints are to be applied, and the whole fixed by means of the tapes, as in the ordinary apparatus for fractures of the thigh. Lastly, by turning the winch, the iron sole is lowered, drawing the foot, to which it is attached, along with it; and the superior extremity of the splint is pushed upward, and the member elongated to the necessary extent.

DR. HARTSHORNE'S SPLINTS.

These are generally spoken of as modifications of Boyer's, but differ so much from them as to be almost entirely new. They are

Composed of an outer splint, long enough to reach from four inches below the heel nearly to the axilla, and of an inner splint which goes from the same point, up to the perineum. In the lower extremity of each of these is a long mortise, in which the foot-board slides, or is moved by the screw. The upper end of the inner splint is covered with a pad of horse-hair, which is again

Fig. 168.

covered by buckskin. An ordinary gaiter and a handkerchief complete it.

Application. — Fix the gaiter or band on the foot, and pass the splints on each side of the limb

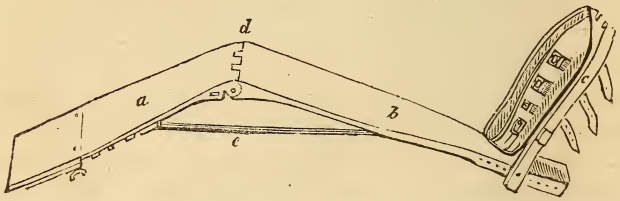
till the inner or padded one touches the perineum. Then attach the tapes of the gaiter to the upper block or foot-board, and by turning the screw draw it down, and the limb will follow this movement till the perineum bears on the pad, when it is stopped, and the counter-extension made by means of the padded end of the inner splint.

Junct-bags may be placed between the splints and the limb if they press too much against it, but generally this is not the case, and in cases of compound fracture where they would be soiled by the discharges, it is an advantage to omit them. It is chiefly in cases of this kind that we can use these splints to the greatest advantage. The extension and counter-extension being kept up chiefly by the *inner* side, we can remove the outer splint and dress the wound without taking the extension from the limb. Care must, however, be observed in the use of this splint, that the pressure upon the integuments of the perineum does not produce a slough.

AMESBURY'S APPARATUS FOR FRACTURES OF THE FEMUR.

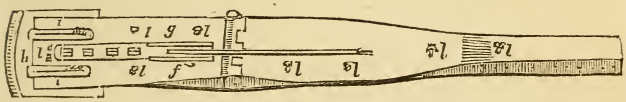
Composition. — This apparatus is divided into three portions, independent of splints and straps;

Fig. 169.



one is for the thigh, Fig. 169, *a*; another for the leg, *b*; and the third for the foot, *c*. There are two thigh-pieces made to each apparatus, one of which is bevelled off at the lower end to the right and the other to the left, so that when one of them is fixed to the leg-piece, which is hollowed out to receive the back of the leg, the leg and thigh-piece together are adapted to the natural line of the right limb; and when the other thigh-piece is joined to the leg-piece, they are adapted to the natural line of the left limb: this arrangement Mr. Amesbury considers necessary, in order to preserve the figure of a perfectly formed limb, which is not straight, but turns inward a little at the knee. The leg and thigh portions are connected by means of a little steel or brass pin, *d*. Behind the apparatus is a steel bar, *e*, coated with brass, and fixed to the back of the leg-piece. To the upper end of this bar is fixed what Mr. Amesbury calls a brass foot, Fig. 170, *f*, to which is

Fig. 170.



attached a bolt acted upon by a spring. There is a hole in the centre of this brass foot, which is traversed by the bolt in the transverse direction. At the back of each thigh-piece is a rack, *g*, with several projections, each having a hole bored through the middle, for the purpose of receiving the bolt attached to the brass foot-piece. The

foot-piece is connected with the steel bar in such a manner as to be easily fixed upon either of these projections. By being fixed upon either of these, except that nearest the leg-piece, the leg and thigh-pieces become fixed together so as to form a double-inclined plane (see Fig. 169); the angle of which may be varied at pleasure by altering the position of the brass foot-piece from one of the teeth or projections of the rack to another. At the upper end of the thigh-piece is a sliding brass plate, *h*, Fig. 170, so adapted that it may be applied to either of the thigh-pieces at pleasure. This contrivance allows of the thigh part of the apparatus being adapted to thighs of various lengths. The upper end of this plate is turned off, so that, when it is properly padded, it may bear against the tuberosity of the ischium without injuring the integuments. At the back of the sliding plate are placed a couple of brass bars, *i i*, which answer the double purpose of rendering the sliding plate more secure when it is fixed upon the thigh-piece, and of preventing the pelvis-strap, to be noticed presently, from slipping from the apparatus. There are little studs, *l*, placed at the back of the apparatus, for the purpose of receiving the straps by which the apparatus is confined to the limb.

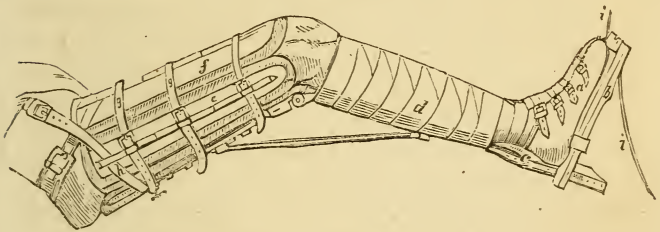
The pelvis-strap is of leather, furnished with a sliding pad, and is long enough to reach round the thigh and round the pelvis.

Three short splints are also required, to be placed upon the thigh.

Application. — The apparatus and splints being properly padded, the surgeon commences by placing the pelvis-strap between the bars and the plate

or sliding portion ; he then applies a single-headed roller, *d*, Fig. 171, spirally about the leg from the toes to the bend of the knee. In the next place,

Fig. 171.



an assistant takes the small of the leg in one hand, and places the other under the knee to raise the limb, and at the same time to keep the knee bent while the surgeon places the apparatus under it. When the limb is properly placed, the shoe, *a*, previously padded in the inside, is buckled to the foot, while the foot-board, *b*, and leg-piece, are placed at nearly right angles : this gives the foot support, and steadies it. The leg is to be supported along the whole of its under surface in order to give it an equal bearing upon every point of the apparatus, and this is done by means of tow or wadding, *c*, placed under the small of the leg, between the long pad and the leg-piece. The leg is fixed upon the apparatus by a roller carried spirally round both from the ankle to the bend of the knee. To confine the fractured parts in their natural position, the assistant takes the apparatus and the knee between his hands, and extends the thigh gradually in a line with the thigh part of the

apparatus, which the surgeon supports against the back of the thigh. When the surgeon has coaptated the fragments of the bone, he applies the splints; the first, *e*, on the outer side of the thigh, from the great trochanter to the lower part of the outer condyle; the second on its inner side, reaching from the pubes to the lower part of the inner condyle; and the third, *f*, upon the fore-part of the thigh, from a little below the superior anterior spinous process of the ilium, to the base of the patella. The splints are kept in place by the straps, *g g g*, fixed to the studs on the back part of the apparatus. Lastly, the pelvis-strap, *h*, is to be carried round the limb, under the strips of leather of the splints, and made to cross on the outer side, while the *buckle-end*, with the sliding pad, is carried round the pelvis and made to meet the other end in front, where it should be buckled. The tapes, *i i*, serve for fixing the lower part of the apparatus to the foot of the bed.

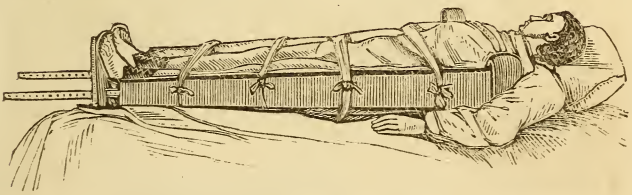
GIBSON'S MODIFICATION OF HAGERDON.

Composition. — Two splints half an inch thick, formed at the upper extremity like the head of a crutch, five inches wide just below this head, five feet and a half long for an adult, and tapering towards the lower end which is about two inches wide. These lower ends for the extent of a foot are straight, and have six or eight holes at equal distances, large enough to receive a stout peg intended to secure the foot-board. Shoulders are made in the splint just above the last peg-hole, to prevent the foot-board from ascending. The foot-board itself is made of seasoned, tough wood, an inch thick, twelve inches long, and nine wide. In

this are three rows of slits half an inch wide, and an inch and a half long, intended for the straps of the gaiters which are to secure the feet to the board. Two other slits receive the ends of the splints, thus making eleven perforations in the foot-board. The gaiters are like Physick's gaiter, with two additional straps, so that there are two near the instep and two near the heel, long enough to pass through the foot-board, and tie on its back.

Application. — The bed being prepared, as before mentioned, and the patient placed straightly on it, the gaiters are applied to both feet, and the fracture set. The splints with junct-bags, or else the splints themselves padded, are then applied and the foot-board fastened to them; when the feet, protected by two small cushions beneath them, are to be secured to the board by passing the straps through the holes and tying them on the outside, and the splints are to be secured to the body by four or five pieces of rollers.

Fig. 172.



In this apparatus both limbs are confined, and the counter extension is made at the acetabulum of the sound side by means of the sound limb. Consequently, we must guard against any bending of the sound knee, as that would at once do away

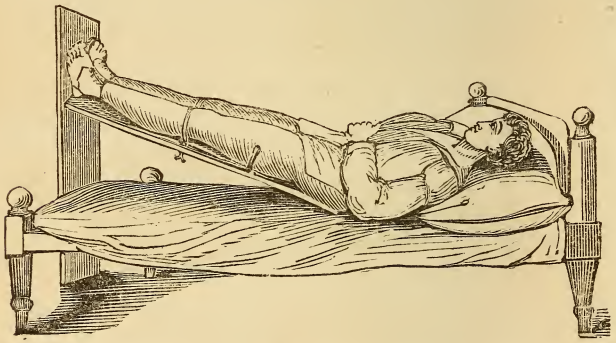
with the use of the sound limb as a splint, and permit shortening.

A very simple apparatus for the treatment of certain cases of this fracture, is to be found in the following plan.

GIBSON'S SIMPLE-INCLINED PLANE.

Composition. — A board sixteen inches wide, two feet four inches high, and with six mortises near its upper extremity, is placed vertically; another board of similar breadth and length is placed horizontally; a third, three feet long, and extending from the extremity of the horizontal one to within ten inches of the top of the upright one, forms an inclined plane, and the whole joined together forms a triangle.

Fig. 173.



At the lower end of the inclined board is an opening six inches wide and eight long, to allow of the passage of fæces and urine to a vessel below. There are likewise two mattresses, two foot cushions, and a pair of gaiters. The larger mattress of the

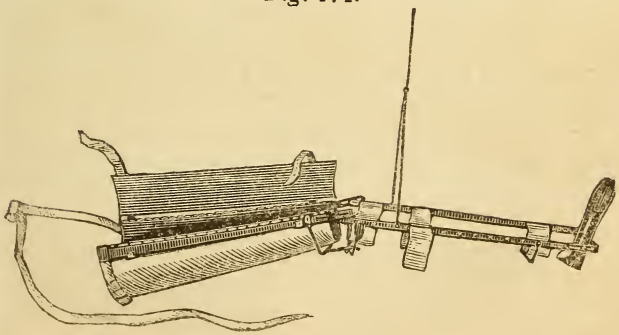
length and breadth of the inclined board is two and a half inches thick, and fastened to the board by straps on its edges. The smaller mattress fills up the opening for the passage of fæces, &c. The gaiters and foot cushions are as before described; and lastly, there are two round pins, each six inches long, which are passed through holes in the inclined plane.

Application. — Place the patient on this, as seen in Fig. 173, the fastening of the feet makes the extension, and the weight of the body the counter-extension, and thus places the limbs in an easy position, and one very favourable to the reduction of any inflammation. Where, from peculiar circumstances, we wish to allow a certain degree of motion to the limb, we may find it useful to employ

PROF. N. R. SMITH'S APPARATUS.

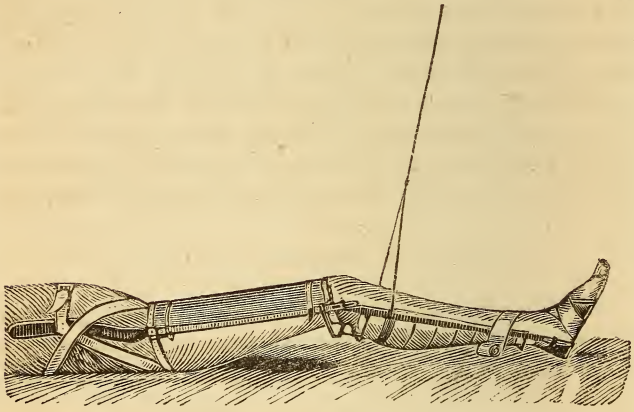
Composition. — This consists of four pieces, viz.: — two concave-inclined planes, one of which is adapted to the inferior surface of the thigh, the

Fig. 174.



other to that of the leg, and united by a hinge corresponding to the knee. The third piece is for the foot, and the fourth connected with the thigh-piece extends up the side of the body. (Fig. 174.) The limb is placed in it, as in Fig. 175, and is then suspended. It is, however, a somewhat complicated apparatus, or at least one that is not readily made

Fig. 175.



at the moment, but makes when applied a very light and excellent double-inclined plane. The figures give a good idea of it, and those who may wish to construct one, will find a minute account of it in all its parts, by Prof. Smith, in Geddings's Baltimore Med. and Surg. Journal, vol. i., 1833.

FRACTURE OF THE PATELLA.

In this fracture the upper fragment is drawn up by the action of the quadriceps femoris, consequently the indications in the treatment are to overcome this, and bring the fragments as closely

in apposition as possible, in order to shorten the ligamentous union, and thus preserve a more perfect use of the limb. To do this, various means have been proposed by Dessault, Amesbury, Cooper, Dorsey, Mayor, Gerdy, &c.

DESSAULT'S APPARATUS.

Composition. — A splint, three inches wide, long enough to reach from the tuber ischii beyond the heel; two, two and a half inch rollers eight yards long, a two inch band of the length of the limb, and some tow, &c.

Application. — The thigh being bent on the pelvis, and the leg extended on the thigh, the limb is supported by an assistant. The long band is then placed on the front of the limb, and held by assistants in its place, until it is fixed by one of the rollers in an ordinary spiral bandage up to the knee. Two slits corresponding to the knee-pan, are then made in the band, to allow the fingers of the surgeon to pass through and bring down the upper fragment, when the roller is resumed, carried round the joint in several figures of 8, and then continued up the thigh, to compress its muscles and fix the end of the band. The use of this band is now seen to be, to fix the turns of the roller by preventing those of the leg from descending, and those of the thigh from ascending. The limb being still elevated, the surgeon applies one end of the splint under the tuber ischii, and then filling up the inequalities of the limb with cotton or tow, extends it on the whole back of the leg, and confines it to the limb by simple spiral turns of the second roller.

This apparatus is very simple, but would perhaps answer as well without the band, as the roller, if properly applied, will certainly not slip after the application of the splint.

DORSEY'S APPARATUS.

Composition. — A piece of wood, half an inch thick, three inches wide, and extending from the buttock to the heel. Near the middle of this splint two bands of strong muslin, about four inches wide, doubled on itself, and a yard long, are nailed at a distance of six inches apart. Two ordinary rollers, two small compresses, and some tow or soft flannel, complete the apparatus.

Application. — An assistant raising the limb, as in Dessault's plan, the surgeon applies an ordinary spiral, to cover in the whole leg and foot, and on reaching the knee, brings the fragments as closely together as possible, and confines them by figure of 8 turns. He then covers in the thigh by the same sort of turns, places the splint properly padded on the back of the limb, and fastens it by spiral turns of the second roller. On coming to the lower one of the transverse bands, it is to be passed above the upper fragment over the compress placed there, and the upper strap passed below the lower fragment, and both secured by a pin or knot, when the remainder of the splint is to be covered in by the subsequent turns of the roller.

This apparatus is the same in principle as Boyer's, but has the advantage over it of being more simple, and easily obtained at a moment's notice, a shingle or strip of wood, a few tacks, and a piece of bandage, being all that is requisite.

MAYOR'S METHOD.

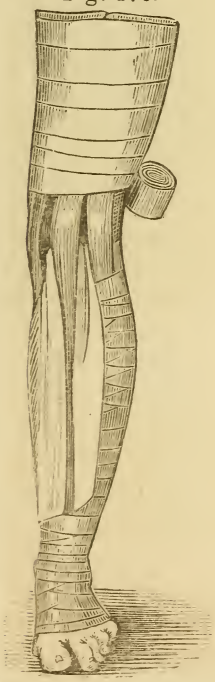
This has been already mentioned under his system, as the tarso-patellæ handkerchief.

GERDY'S PLAN,

Is similar to the uniting bandage for transverse wounds.

Application. — Place an ordinary spiral bandage on the leg and foot; then lay the tailed band so that its ends may correspond with the lower fragment, and fasten it to the leg by a second spiral firmly applied. Place a spiral bandage on the thigh, and laying the slit bandage so that its slits may correspond with the upper fragment, bind it by another spiral bandage, or by turns of the first also firmly to the thigh. Place the two compresses one above the upper fragment, the other below the lower fragment, and, passing the tails of one band through the slits of the other, press upon the compresses, and force the fragments into apposition, by fixing the lower one, and bringing the upper one to it. Then confide the ends of the bands to an assistant, and fasten them by another spiral of the lower extremity, beginning at the ankle and reaching to the groin, with figure of 8 turns at the knee over the whole.

Fig. 176.

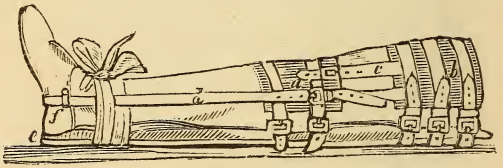


AMESBURY'S APPARATUS FOR THE SAME.

Composition. — Two pads to be placed, one above and the other below the knee, each about five inches wide, and long enough to pass half-way round the limb: the pads are connected by two short straps, and buckles; — five straps, with buckles, to pass round the limb, three above and two below the knee, in order to fix them; — a long strap, to pass from the upper pad, to which it should be fastened, along one side of the leg and under the foot to meet a buckle attached to the same pad on the other side; — a properly-padded straight splint to extend along the thigh and leg; — and lastly, a handkerchief, or a band about three-quarters of a yard long.

Application. — A shoe is first to be applied upon the patient's foot, furnished at the sides with two small loops, *f f*, and the leg extended upon the padded splint, *e*, after which the pads, *a b*, are placed above and below the knee, and secured, together with the splint, by means of the five straps mentioned above; the fragments are then

Fig. 177.



to be brought into close contact by means of the short strap, *c*, and the long strap, *d*, which should pass through the loops of the shoe. The lower

part of the splint is maintained against the leg by means of the handkerchief or band.

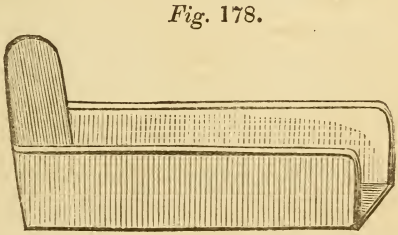
FRACTURES OF THE LEG.

Fractures of one or both bones of the leg, with the exception of the lower end of the fibula, are with us usually treated in the same way. In these, as in other fractures, various means have been proposed, but as the most simple one has seldom or ever been known to fail, we shall confine ourselves to a description of it.

HOSPITAL APPARATUS.

This is *Composed* of an ordinary pillow, and a fracture-box. The fracture-box is made of four pieces of wood, the bottom one, extending from the knee to a little beyond the heel, has fastened to its lower end a perpendicular piece for the foot: to its sides are fastened by hinges, two lateral pieces about seven inches wide, and intended to shut up against the sides of the limb and foot-board, to form the box.

Fig. 178.



Application. — Place the pillow in the box, the limb on the pillow, and, fastening the foot to the

foot-board by a simple band over the instep, tie up the sides of the box, and the dressing is complete.

If it is desirable to apply cold washes, or to protect the pillow from discharges, or if it is a compound fracture, a piece of oiled silk or coach curtain may be laid over it.

This very simple apparatus is all that is used at the hospital for all fractures of the leg, except where, from great lateral inclination in fracture of the lower end of the fibula, Dupuytren's splint is necessary. But this is seldom the case, as the tying of the foot to the foot-board, so as to give it an inclination inwards, and a little extra compression made at the internal malleolus by means of a pad of cotton, is all that is requisite. Attention must, however, be paid to the state of the heel, to see that it does not sink, and thus cause the lower fragment to project anteriorly; and we must, also, see that the foot-board projects beyond the toes, to keep off the weight of the bed-clothes, and prevent their causing the same thing by the extension of the foot. The band across the instep prevents the foot's inclining to either side, and the pressure of the pillow against the limb by the sides of the box prevents lateral deviation.

A simple rule, by which to tell whether a leg is properly set or not, is to see that the edge of the first joint of the big toe corresponds with the inner edge of the patella. This, even if the patient is bandy-legged, will generally keep us right as to the proper position of the limb.

In this apparatus we have the parts constantly before us, can remedy instantly any deviation, and combat any inflammation by cold washes, &c.

If the fracture is a slight compound one, attempts

should be made to close the wound as soon as possible, and promote union by the first intention. To do this, draw it together with adhesive strips, and then apply over them a thick piece of patent lint, well wet with white of egg, so as to cause it to fit very closely to the limb, exclude the air, and form an artificial scab. This should not be removed for several days. If, however, the wound is a serious one, and proceeds to suppuration, nothing is equal to the plan of Dr. Barton.

BARTON'S BRAN DRESSING.

Composition. — A fracture-box, some bran or fine saw-dust, and a little cotton.

Application. — Fill the box, with its sides shut up, one-third full of bran, place the limb in this, fasten the foot to the foot-board as before, and stuff some cotton between the knee and the sides of the box, to keep the bran from escaping. Then fill up the box with bran, so as to cover in the wound and whole limb. This forms a very soft and equable bed for the limb, keeps the flies off from the wound, prevents the fœtor from the discharges, and owing to its absorption of the blood or discharge at the wound, it swells, makes pressure on the part, and thus tends to arrest the hemorrhage, or prevent the formation of sinuses. After two or three days, if we wish to change it, scrape off the bran from the limb, and cleanse it from the wound by a spatula or syringe, and reapply it fresh. In hospitals, this dressing is especially useful, as it preserves the wards from the fœtor of the discharges, which, without this, is sometimes almost insupportable.

It also answers for extensive wounds of the leg

or thigh, the box, in the latter case, being made to extend up to the trochanter of the femur.

After the bony union in any case of fractured leg is tolerably firm, say after six weeks, an ordinary spiral bandage may be applied, and over this two splints of binder's board, softened in hot water so as to mould themselves to the limb, and these may be confined there by another bandage, so as to strengthen the part before the patient attempts to walk about.

Another method of treating fractures of the leg is by the recently revived method of Suetin, and Velpeau, or the Appareil Immobile. In the use of this apparatus, attention must be paid to the nature of the case, the constitution of the patient, &c.; in other words, that it is a favourable case of simple fracture, without much contusion; and it should also be recollected that the bandages used are to be *washed* rollers, *applied as in the French spiral*, so as to leave the heel and toes open to our inspection, as we may then judge of the state of the parts above. In applying it, we must do it with a light hand, so that the bandages may not be too tight, and if the patient complains after its application, so as to show suffering, the *whole must be removed.* If thus applied, it serves a most excellent purpose, but is liable to abuse, without great attention on the part of the surgeon to its proper application. The manner of applying it, and the result of the cases which were among the earliest in which it was tried in this country, will be best seen from the following report of those treated in the surgical wards of the Pennsylvania Hospital, in 1838.

CASE FIRST.—Fracture of both bones of the leg—Application of the apparatus seven days after the accident—Cure without deformity.

George R——, æt. 34 years, a shoemaker by trade, and of temperate habits, was admitted into the Hospital, Dec. 25th, 1838, with a fracture of the tibia, oblique at its lower third, and one of the fibula at its upper third, caused by a fall upon the ice. The limb at first was placed in the fracture-box, and evaporating lotions used to reduce the inflammation, which was considerable. On the third of January, seven days after the accident, the immoveable apparatus was applied in the following manner. A *washed* roller was smoothly applied, from the toes to the knee, cotton being placed along the spine of the tibia to prevent excoriation from the turns of the bandage, and also in the cavity, on each side of the tendo-Achilles. This was well rubbed over with starch, made thick and smooth by being boiled for twenty minutes. A second roller was then applied from the knee down and also well covered with starch. Two pieces of binder's board cut to fit the sides of the leg and extend from below the knee to below the malleoli, were soaked in water until soft. They were then rubbed with starch, and applied to the leg over this, so as to surround the limb, except for the breadth of a finger on the front and back; small cuts being made at the lower end to cause it to fit the projection of the malleoli, and also at any other point where it bulged out. A third splint, made to fit the foot, and slit at the end so as to enable it to turn up behind the heel, was then applied to the foot, starched and secured by a

third roller from the toes up. This was coated in like manner — a fourth applied over all, and the dressing completed by starch, which kept the whole smooth and tight without the aid of pins.

The limb was now laid carefully in an *empty* fracture-box, a little cotton placed under the heel, and the foot tied to the foot-board, where it was allowed to remain for four days, at the expiration of which period the whole was dry and hard, the limb being cased as firmly as in plaster.

The patient was then allowed to remain in bed without any other dressing except the splints; and on the ninth of January, thirteen days after the injury, a bandage was doubled around his neck, carried down behind the calf of the leg, then in front of the ankle, over the instep, and round under the foot to the instep again so as to form a sling and raise the foot a little from the ground, when he was allowed to walk about with crutches. In this way he continued until February 7th, when the apparatus was taken off, before the class, the limb being perfectly straight and firm, and without the slightest deformity; and on the 13th of February, seven weeks after the injury, the man was discharged. In this instance, the apparatus was not touched until the fourth week, when a simple roller was applied to tighten it, owing to looseness consequent on the shrinking of the muscles. One of the objections raised to the use of the apparatus was thus readily obviated without injury to the patient; for, as the splints did not meet before and behind the leg, it was easy to fold the surplus bandage in, without causing any welt on the skin, while the bandage, having been previously washed, shrunk but little.

Case Second.—Fracture of the fibula two inches above the joint—Application of the apparatus seventeen days after the injury.—Cure without deformity.

Patrick D——, æt. 42 years, a labourer, fell off a step on the 15th of January, and fractured his fibula obliquely, two inches above the external malleolus. Owing to the inflammation, leeches, and the antiphlogistic course, with the use of the fracture-box, were continued until February 1st, seventeen days after the accident, when the apparatus was applied as in the preceding case; except that the splints were continued under the bottom of the foot, being slit up so that the fold under the foot did not interfere with the application of the splint to the sole, thus preventing all motion at the ankle-joint. After the apparatus had been dried in the fracture-box, with the foot *well turned in*, for five days, the patient was allowed to walk about, and on the 10th of February, twenty-six days after the accident, he walked up to the third story of the house, and was operated on by Dr. T. Harris for cataract. On February 21st, the apparatus was removed—there being not the least deformity perceptible even to the touch.

Case Third.—Oblique fracture of both bones of the leg—Application of the apparatus nine days after the accident—Cured.

Patrick C——, æt. 23 years, a labourer, whilst working on a rail-road on the 18th of January, was knocked down by the caving in of a bank of earth, and both bones of his leg broken obliquely, near the middle. He was treated in the

usual way by the fracture-box, until the 27th of January, when the starch dressing was applied. January 31st, four days afterwards, was allowed to rise and walk, by degrees, more each day, until February 25th, thirty-eight days after the accident, when the apparatus was removed. The limb was perfectly straight without any motion between the bones, and strong enough to allow him to walk upon it. In this instance, the apparatus was not touched until the sixth day after its application, when on his complaining of its tightness over the instep, the foot was soaked for a few minutes in hot water, and, by introducing a spatula under the bandage, it was raised sufficiently to free the point of pain. Being then allowed to harden, he suffered no inconvenience afterwards.

The next three cases were of fractures of the thigh, in which, as there was but the one bone to act on, and other objects to be considered than the mere apposition of the fractured ends, it was applied at first, at a more advanced stage.

CASE FOURTH.—Oblique fracture of the middle of the femur—Application of the apparatus fifty-three days after the accident—Cure without deformity.

Francis McG——, æt. 22 years, of good habits, fell, on the 22d of November, down the hatchway of a vessel, and fractured his clavicle and femur. The clavicle was dressed with the usual apparatus, and the femur treated by the long fracture-box, fastened on the double-inclined plane, until January 14th, fifty-three days after the injury, when the union not being firm, although there was considerable bony deposition, the apparatus was ap-

plied as follows: — A roller was carried smoothly up from the toes to the groin, the limb being held up and extended by assistants; this was starched as in the first case, and covered by a second roller. A long splint of binder's board was then applied, from the tuberosity of the ischium to below the knee, on the back part of the thigh, and another from the groin to the patella, in front — so as to surround the limb entirely, except for the space mentioned in the dressings of the leg. These were then covered in the same manner as the splints in the first case, and a simple roller applied from the toes up to the lower part of the knee, so that it could be renewed at pleasure. The limb was then laid on a simple-inclined plane, until the apparatus dried. Five days were necessary to dry it, when the man was allowed to walk about, the limb being supported by the sling before mentioned, and the splint behind preventing all flexion at the knee. On the 2d of February, about ten weeks after the accident, the apparatus was removed, without there being found any deformity or perceptible shortening in his gait, the measurement showing it to be a little more than a quarter of an inch less than the sound limb; and on the 7th of February, the patient left the hospital.

Cases Fifth and Sixth.—Oblique fracture of the upper third of the femur—Application of the apparatus thirty days after the injury—Perfect cure.

Thomas H ——, æt. 26, a labourer, fractured his thigh at its upper third, December 6th, about fifty miles from town. He was dressed in the neighbourhood, and did not arrive at the hospital till the third day after the accident, owing to the

destruction of part of the rail-road. The limb was much inflamed and swollen, and was treated at first by the inclined fracture-box,* lotions, &c., until January 6th, when the starch apparatus was applied to it, and dried in the same manner as in the preceding case. On the 14th of January, the man was allowed to walk about, and the apparatus remained untouched, till its removal, February 12th, there being perfect union, and only one-eighth of an inch shortening by close measurement, and none perceptible in his gait; and on the 21st of February, eleven weeks after the injury, he was discharged.

The same apparatus was applied to Patrick E——, (who was admitted February 6th, with an oblique fracture, caused by blasting,) on the 19th of February, thirteen days after the accident, and enabled him to sit up in bed five days afterwards, and on February 25th, to walk the length of the room. On his standing up, he feels too weak to walk readily, but has every prospect of doing so shortly. At present, he complains of no inconvenience from the dressing, and is able to turn about in his bed; the limb being but little shortened by measurement over the splints. The case got well, but with marked deformity, so much so as to make me resolve never again to apply it to the thigh before there was consolidation of the fracture.

In the case of *fractures of the leg*, it enables the patient to move about in fifteen days, with perfect safety. It has not been deemed expedient to apply it so early as M. Velpeau has done, owing to the severe contusions which complicate most of

* Chapman's double-inclined plane, with a fracture-box on it.

the fractures received here; but, with this restriction, it might, as far as the experience of these cases prove, be used in all simple fractures, as few will be found, in private practice, more severe than those on which it has been tried. In hospital practice, it promises to be of great utility, by doing away the risk of sloughs on the sacrum, from the constant pressure consequent on the long confinement on the back, and adds very materially to the patient's comfort, by allowing him to rise to a window, or to go from one apartment to another. In case second, it enabled a man to rise and undergo an operation for cataract, in a place where the light was better than in his own room.*

Since then, I have seen it much used by M. Velpeau, and do not hesitate to repeat the assurance of its utility to such cases of fracture of the leg as have been mentioned; but I doubt the propriety of its use in fractures of the femur before there is consolidation.

In very oblique fractures of both bones, extension and counter-extension is sometimes necessary to prevent shortening. To obviate this, we should apply Physick's modification of Dessault's splints for fracture of the thigh, or Hutchinson's leg splints, though the first is preferable till the tendency to spasm of the muscles has gone off, when the usual means may be employed; but we again repeat, that it is seldom any other dressing than the fracture-box is required.

AMESBURY'S APPARATUS FOR FRACTURES OF THE LEG.

Composition. — A thigh-piece, properly shaped to receive the back of the thigh, having a pair of

* Medical Examiner.

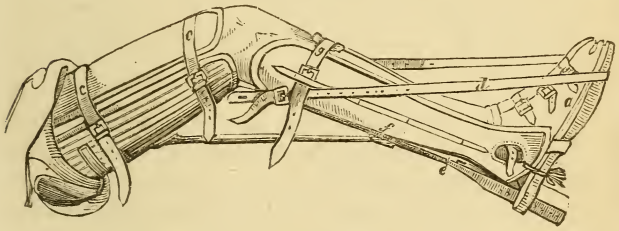
lateral splints connected with it, and some studs for the retention of straps; — a leg-piece, immoveably connected to the thigh-piece at an angle, and hollowed out for the reception of the back of the leg; — a foot-piece, which may be so shifted as to adapt the leg-piece to the length of the leg. The foot-piece should not rise higher than is necessary to form a right angle with the leg-piece when connected with it. There are some holes in each side of this, and a strap is attached to it, bearing upon one end a buckle; a shoe, with a wooden sole, for the reception and retention of the foot, to which are attached two straps for connecting it with the foot-board. The shoe is supported by a foot-strap, which, when in use, extends from one side of the thigh-piece round the lower part of the foot-board, where it is passed under a strip of leather placed there to keep it in its place, and then carried up to the opposite side of the thigh-piece, where it is buckled.

The apparatus ought to be first adapted to the sound limb in cases of simple fracture of the leg, and well padded; a small concave pad, too, should be placed on the inside of the heel of the shoe, and another pad upon the sole. Two side splints are required, the outer one extending from the foot-board to the upper part of the outer condyle of the femur, and the inner one from the foot-board to the inner condyle; — also a split deal shin-splint; and in cases of oblique fracture, a thin pad to be applied upon the instep, covered with a piece of paste-board, a little wetted, which, when dry, serves to equalize the pressure and keep the instep easy.

Application. — In the first, or Inflammatory

stage. — The shoe, *a*, containing the heel and sole-pads, should be carefully placed upon the foot; the instep pad should then be placed upon the instep, and the shoe closed over it, and closely

Fig. 179.



confined to the foot by means of the buckles and straps attached to it for that purpose. An assistant should then place one hand under the knee, and, taking the foot in the other, raise the fractured limb, bringing it round so as to let it rest upon the heel. When the limb is raised, the surgeon places the apparatus under it, and brings the ankle of the same opposite the bend of the knee, directing the assistant to lower the limb upon it.

The surgeon now fixes the shoe, *a*, to the footboard, *b*, by means of the straps attached to the sole. By the aid of this shoe, he is enabled to raise or lower the foot according to the length of the heel or thickness of the calf, so as to bring the lower portion of the fractured bones into a proper line with the upper, as far as respects any angular projection backward or forward. A padded splint should be placed upon the front of the thigh, and the whole of the thigh-part of the apparatus

fixed to the thigh by means of the straps, *c*. That done, the foot-board should be raised nearly to a right angle with the leg-piece, and fixed in this position by the foot-strap, *d*, care being taken that the heel does not bear against the sole of the shoe. The fractured ends should next be noticed; and if the foot requires to be raised or lowered, it may be done by means of the strap which confines the shoe to the foot-board.

The part of the pad, *e*, which lies under the small of the leg, should be raised and supported in close contact with it by means of tow placed between the pad and this part of the apparatus, so that the whole length of the back of the leg may have an equal bearing upon the apparatus.

The lateral splints are next to be applied, the longest upon the outer side of the leg, and the shortest upon its inner side. The lower ends of these splints should be fastened to the foot-board by means of narrow tapes passed through the holes at the sides, and the upper end kept close to the leg by the circular strap, *g*, passed round the limb over the splints and the apparatus.

With respect to the position, the limb thus fixed should be placed with the apparatus resting upon the heel; the two planes should be connected, as seen in the wood-cut, by means of the steel bar, which forms part of the apparatus for fractures of the thigh, and the whole steadied by tapes attached to the foot-board, and passing off from thence to the sides of the foot of the bed. Surgical applications may be made by unbuckling the circular leg-strap, and throwing back the side splints.

When the inflammation is subdued. — Some strips of soap-plaster, each about an inch and a

half wide, should be applied with very moderate tightness round the limb, and sufficiently close; they should pass from the ankle to a considerable distance above the fracture. The ends should be crossed on the sides or front of the leg, and cut off, so as to be easily turned back, when it is necessary to observe the state of the skin. Some strips, or a short roller, should also be passed round the foot to prevent œdematous swelling in that part. When this is done, and the side splints re-applied, the shin-splint should be properly adjusted, and the whole leg-part of the apparatus supported by three circular straps and buckles.

The cross-bar may be now removed, and the apparatus furnished with a sling or thong of leather fixed to the lower end of the leg-part of the apparatus; by means of this the limb may be moved passively at pleasure; the patient may recline upon a sofa, or rest his leg upon the seat of a chair. He may walk, too, with the assistance of crutches, passing in this case the sling over the neck, as in the ordinary way; the movements of the limb, however, should be always passive, and never by the action of its own muscles. In a fortnight or three weeks' time, according to circumstances, the foot-board should be shifted a little higher up the leg-piece, to press the fractured ends together, and hasten their consolidation.

Oblique Fractures. — In these cases extension must be made in the following manner: — the thigh-piece of the apparatus must first of all be pressed up closely against the back of the thigh, and the foot-board shifted down, so as to make the space between the foot-board and the thigh-piece longer than the leg; an assistant then grasps

the foot and ankle in his hands, and makes gentle extension in the natural line of the bone, so as to bring the fractured parts into proper adaptation; when this is done, the surgeon keeps up the extension by buckling the strap, which is fixed transversely to the shoe, round the foot-board. Great care must be taken that the broken extremities unite in the relative position which they naturally occupy; for this purpose auxiliary pads and rollers must be judiciously applied, according to the bone affected and the nature of the obliquity. The fullest particulars relating to this part of the treatment will be found in Mr. Amesbury's "Practical remarks on the Nature and Treatment of Fractures of the Trunk and Extremities."

DUPUYTREN'S APPARATUS FOR FRACTURES OF THE LOWER EXTREMITY OF THE FIBULA.

Composition. — A wedge-shaped cushion, about two-thirds filled with bran or cotton, and of sufficient length to extend from the malleolus internus to the knee; — a strong splint, about two feet long and three inches wide; — and two single-headed rollers, from four to five yards long.

Fig. 180.

Application. — As soon as the fracture is reduced, the wedge-shaped cushion, *e*, with the base

directed downward, is to be applied along the inner side of the leg; the splint, *b*, is next to be applied on this, and made to extend about four inches beyond the sole of the foot; these two portions of the apparatus should be confined to the limb, *a*, above by one of the rollers passed in circulars round it, *c*, from just below the knee to a short distance above the fracture, and below, by the second roller, or by the same one carried round the foot and instep in the form of a figure of 8, *d*. Care should be taken in applying this roller to draw the foot inward towards the splint, and maintain it firmly in the state of adduction, and the posterior part of the limb should repose, in a state of demi-flexion, upon pillows made to form an inclined plane. In the figure, the turns of the upper roller do not come far enough down, they should extend to within an inch or two of the fracture.

APPARATUS FOR FRACTURE OF THE OS CALCIS.

Composition. — A bit of strong roller, two inches wide, and of sufficient length to extend from four inches beyond the foot to the lower third of the thigh; — two single-headed rollers, eight yards long and two and a half inches wide; — two graduated longitudinal compresses; — and a strong, well-padded, pasteboard splint, moulded to the fore-part of the foot and leg, and reaching from the roots of the toes to a certain distance above the knee.

Application. — The foot and leg being held by an assistant, the first in the most complete extension, and the second demi-flexed, another assistant should be requested to support the thigh, laying hold of it at its middle third. The surgeon

then proceeds to apply a padding of lint or charpie over the toes, and extends the strip of roller from the instep along the sole of the foot, the back of the leg, and the lower and posterior part of the thigh, and the band being maintained thus by the assistants, the surgeon equalizes the posterior part of the ankle-joint, by means of the soft material, and applies the graduated compresses on each side of the tendo-Achillis. Next, taking one of the rollers, he fixes its initial end by a few circulars applied about the ankle, which secures, at the same time, this portion of the band, and reflects the remainder of the latter backward, and covers the whole of the foot. He now passes several figures of 8 about the heel, in order to embrace the separated portions of the bone, and maintain them in apposition, and then carries the roller to a short distance above the knee by a simple spiral bandage of the leg, and reflecting the upper part of the band downwards, fixes it by a few horizontal circulars just below the knee. In the last place, the padded splint is placed upon the fore-part of the limb and confined by the second roller, carried from the roots of the toes to the middle third of the thigh, and the limb is extended over a pillow, so as to form a double-inclined plane.

In fractures of the metatarsal bones or of the toes, there is generally more occasion to combat the effects of injury to the soft parts than to set the fracture. We should, therefore, place the limb in a fracture-box, and elevate it to drain the blood from the part, apply cold washes, &c., and afterwards, if necessary, treat it as a fracture of the bones in the hand, though this will very rarely be necessary.

FRACTURE-BRIDGES, ETC., are often spoken of, to keep the weight of the clothes off the foot, but nothing more is necessary than two halves of a common hoop tied together in their centres, as shown *in the fracture of the thigh by Physick's plan.*

DISLOCATIONS.

In the treatment of these injuries there is little that concerns us in a work of this kind. The causes, line of direction of the force causing the dislocation, and the lines of the extending and counter-extending forces, are so important, and would need so much space as to require almost a volume for themselves. Suffice it, then, for us to say, that the bands by which the extension is made, when considerable force is required, should always be fastened to the limb by means of a *wet circular*, or *spiral roller.* To do this, soak an ordinary cylinder or single-headed roller in water 15 or 30 minutes before it is to be used, so that it may be well wet, and then having made a few circular or spiral turns around the limb, place the towel or other band on the point whence the extension is to be made, and fasten it by other circular turns of the same roller. The object of wetting the roller here, is merely to make it adhere more closely to the part, and prevent the extending band from slipping. The counter-extending force is then to be applied by another towel or broad band placed at the desired point. After the bone is reduced, the limb is to be kept at perfect rest for several weeks, by means of some of the bandages before mentioned, and which any

one can now readily apply without the necessity of tedious repetition. Any one of the dressings here mentioned for fracture, is equally applicable to dislocations after their reduction, and we therefore refer, for the details of this subject, to all the numerous works on Surgery.

PART FOURTH.

OF THE MINOR SURGICAL OPERATIONS.

Under this head, we class all the operations of Surgery which do not require an extensive division of our tissues, and shall, consequently, here treat of the different kinds of bloodletting, of issues, setons, and moxas, injections, vaccination, and tooth-drawing. First —

OF BLOODLETTING.

By this term, we understand the use of every means of taking blood from the body, employed with a view of relieving or curing disease. These operations may, therefore, be divided into several kinds, according as they are practised upon the superficial veins by means of lancets, leeches, cups, &c., or upon the arteries. When the extraction of blood is made by a single opening, *cut* in one of the veins, it takes the name of Phlebotomy, or General Bloodletting; when from an artery, that of Arteriotomy; and when done by the aid of leeches, or cups, it is especially designated as Local Bleeding. First —

OF PHLEBOTOMY.

This operation is practised upon the veins of various parts of the body, as at the bend of the arm, the back of the hand, the leg, or the neck, though the first is by far the most common. At the point where this is performed, we find generally five veins arranged, so as to form a figure not unlike the letter M. These are, the Cephalic, the Basilic, the Median, and the Median Cephalic, and Median Basilic; for the surgical anatomy of which, we must refer to other works, as a proper description of their relations would be too diffuse for a work like this.

The easiest vein to bleed in at the bend of the arm, is the Median Basilic, but it is at the same time more dangerous than the Median Cephalic, on account of its position to the artery, and to branches of the internal cutaneous nerve. Generally, however, we take the fullest vein, provided the artery is not too near, and leave the nerves to chance. In thin persons the veins are more prominent and distinct than in fat ones, but they are also more likely to roll under the lancet; whilst in fat people they are more firm, though less easily seen: we must, therefore, accustom ourselves to bleed by the touch, rather than the sight; and to do this, practice our fingers on deep seated veins, or those in fat arms, till we can distinguish the elastic feel of a vein, from the tenseness of the tendon, or the pulsating cord of an artery.

Operation. — Previous to bleeding at the bend of the arm, a simple circular bandage, or a ligature, should be placed, with moderate firmness,

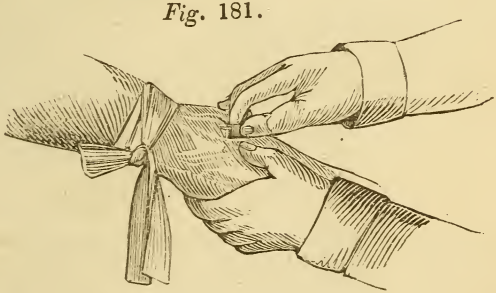
just above the elbow, so as to arrest the circulation in the veins. It must not, however, be so tight as to arrest that in the arteries, as may be always told by placing the fingers on the pulse. After a certain amount of friction to fill the veins, the forearm is either held in an extended position by an assistant, or placed between the chest and the bend of the surgeon's arm, or in his axilla, or the patient may rest his hand on the top of a stick. The surgeon then feels under the vein, by making firm pressure on it, for the position of the artery, and if it is felt pulsating, should open the vein by a more horizontal cut than is usual, or choose another vein, or change the relative position of the vein and artery by strongly pronating the hand. He then places the thumb or fingers of his left hand on the vein below the point at which it is to be opened, in order to steady it; and holding the lancet in his right hand, and facing the patient, if he is bleeding in the right arm, or in the same hand, with his back to the patient if in the left arm, he cuts through the integuments, and opens the anterior parietes of the vein, still pressing on the vein, below the opening with the left hand. The basin or cup to hold the blood being previously placed, and the clothes around protected by a sheet, he then removes this hand from off the vein, and immediately the blood flies into the bowl. This is a neater plan than that of allowing the blood to escape immediately after the vein is opened, as it protects the clothes or bed from the blood.

The Lancets with which we bleed are of two kinds, viz.: the Spring and the Thumb Lancet; and either is used, according to the views of the

operator or the wishes of the patient, there being no material advantage in the use of one rather than the other.

If the Spring Lancet is preferred, it should be held between the forefinger and thumb of one hand, with its blade obliquely to the circumference and axis of the vein; so that, on the spring being

Fig. 181.



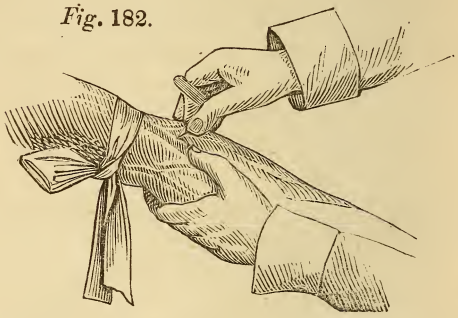
touched by the middle finger, the blade may be driven into the vein obliquely to its axis, and also a little on its side, as we are then less likely to wound subjacent parts.

If, however, the Thumb Lancet is the one used, bend its blade to a right angle with the handle, and place it in the mouth, with the point of the blade turned from the hand that is to take it. Otherwise, when, after completing the preliminaries, we put the hand to the mouth to seize the instrument, we should be apt to injure ourselves by sticking its point into our own hands.

In using this lancet, seize the blade between the thumb and forefinger of the hand that we prefer, and rest the third finger of the same hand on the

arm as a point of support; then placing the point of the lancet on the vein, push it suddenly inwards, upwards, and outwards, depressing the handle in a circle, so as to make a free incision in the line before spoken of; and having drawn the

Fig. 182.



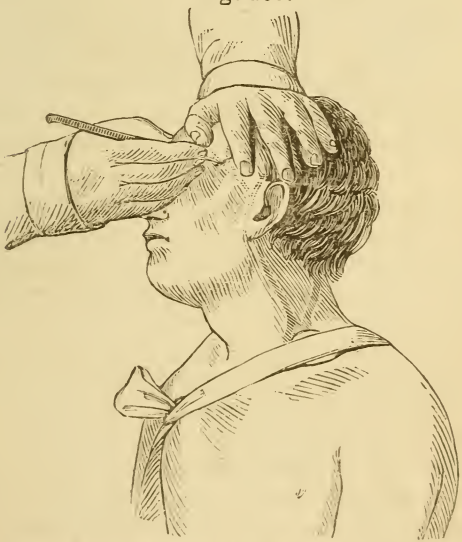
amount desired, undo the ligature above the elbow, seize the skin about the opening between the thumb and fingers, so as to close the wound, and wiping the arm clean from the blood, place a small compress over the opening, confine it by adhesive strips, or by a figure of 8 bandage of the elbow, as before spoken of, and place the patient in an easy position. Particular attention should be paid to the cleansing of the lancet after the operation, in order to prevent difficulty in our next call for its use, as a dirty lancet frequently causes abscesses of the part, gives rise to phlebitis, and endangers the life of the patient. If the opening in the skin and that in the vein do not correspond, a bloody tumour, called a Thrombus, will be formed from the blood escaping into the subcutaneous cellular substance. To remove this, enlarge the opening in the skin, and press upon the tumour; or else leave it to be absorbed by nature, assisted by moderate pressure.

In Bleeding in the Hand, the only rule is to open with a thumb-lancet that vein which is most easily seen; these are generally the vena Salvatella, or the cephalic of the thumb: avoiding the tendons, and also guarding against a deep puncture for fear of injuring the parts beneath.

Bleeding in the Jugular Vein is seldom practised, on account of the danger of the introduction of air into the vein. When, however, it is deemed necessary, it should be done as follows: —

Place a thick, graduated compress on the root

Fig. 183.



of the vein just above the clavicle, and fix it by a narrow cravat, the ends of which should tie on the opposite axilla; or else apply an oblique ban-

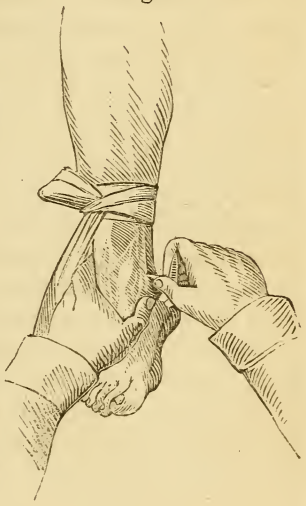
dage of the neck and axilla, as before shown : or, we may compress the vein with the thumb ; though by this plan there is more danger of the entrance of air, as the compression is apt to be more imperfect. If the vein does not become apparent from this compression, direct the patient to move the jaws as in mastication ; and when it is filled, open it with a thumb-lancet at its lower third, and place a bent card, or other substance likely to form a little trough, just below the opening, so as to carry the blood off to the receiver and prevent its trickling down the side of the patient. Having taken the amount desired, we close the orifice, as in the arm, by pressure of the thumb and forefinger, and fasten a compress over it by adhesive strips *before removing the compression* which filled the vein, as we thus ensure the non-entrance of air, which is very apt otherwise to prove almost instantly fatal.

Bleeding at the Ankle is generally performed in the internal saphena vein just above the malleolus, where it is very superficial, though it is also occasionally done on the foot itself, or on the external saphena vein.

Operation. — In order to bleed here, we require the ligature, &c., as in the other cases, and also a bucket of warm water, in which to plunge the foot previous to the operation. The patient being seated, the limb is placed in the hot water as high as the calf, in order to assist the filling of the vein and render it more apparent. After some few minutes, it is then to be removed, the ligature applied about four inches above the malleolus, and the heel placed upon the point of the knee or on a low stool. A *thumb-lancet* being held in

the mouth, and the vein steadied as before shown, it is then seized by the hand which is most convenient, and the vein opened by a wound, which should be rather longer than that made in the arm, in order to give a free discharge to the blood, which here seldom escapes in a jet; it being more common to have to replace the limb in the warm water, in order to facilitate the flow of it, than to see the blood flow in a stream. The wound should not be allowed to sink into the water, but to remain just above it, and the amount of blood taken must be judged of by the discoloration of the liquid. When satisfied as to the proper quantity, it only remains to remove the ligature, wipe the limb, and confine a compress over the opening by the figure of 8 bandage of the ankle. The only accident likely to result from bleeding at this point is, the wounding of the saphena nerve, the arteries being distant. Should the nerve be wounded, either in this or any of the other operations, it will be shown by pain, by twitchings, tingling, &c. To treat this, we should apply a warm poultice, keep the limb at perfect rest for a couple of weeks, and use the antiphlogistic system generally.

Fig. 184.



Bleeding is occasionally followed by irritation

of the edges of the wound, by abscess, or by erysipelas. Any of these will be best combated by the use of the above means in the first stage, and such subsequent treatment as the knowledge of each practitioner will readily indicate.

From want of proper attention in the selection of the vein, or from want of skill on the part of the operator, it occasionally happens that an artery is opened. This serious accident may be readily told by the brighter red colour of the blood, by its escaping in jets which are synchronous with the pulsations at the wrist, by the blood continuing to flow, notwithstanding firm compression of the vein below the opening, or by noticing the change in the colour of the blood produced by a very firm compression of the artery itself above the ligature. When thus satisfied of the nature of the accident, we should endeavour to prevent our suspicions of it being seen by those around; and if the state of health of the patient does not absolutely forbid it, let the blood flow till fainting is induced, when we should arrest it by a firmer compression than is requisite when the vein alone is opened. To do this, make, by means of several small graduated compresses, or by a thick pyramidal compress, a cone, the point of which should rest upon the wounded vessel; fix it by a firm figure of 8 bandage of the elbow, and apply the Spiral of the Upper Extremity firmly, from the fingers up to the upper part of the limb. This treatment is to be continued for fifteen days or more, by which time the closure of the opening in the vessel is generally effected, when most probably an operation for aneurism will be required, though this is not absolutely certain, — Velpeau and others having seen

cases in which the opening in the artery closed, without there having been at any time sufficient compression to stop the pulse at the wrist. Let it, however, be remembered that proper attention will enable us to avoid this serious accident, and that when it happens, it will be generally our own fault.

Besides the veins here mentioned, bleeding was formerly practised in many others, as the occipital, auricular, frontal, sub-lingual, dorsalis-penis, &c., but the introduction of leeching has done away with the operations on these veins. Where, however, leeches cannot be had, and it is desirable to take blood directly from the part, these veins may be opened by operating as in other veins. These operations are always performed by a thumb-lancet, the orifices in the external veins being afterwards closed by a compress and adhesive strips, &c.; that in the sublingual, &c., by the application of cold, or salt and water, or astringents, &c.

ARTERIOTOMY.

This operation, which was formerly practised by the surgeons of the sixteenth, seventeenth, and eighteenth centuries, and highly thought of by Hippocrates, Celsus, and Galen, has been almost entirely abandoned by those of our own times, no one now ever thinking of bleeding in the radial artery, or opening the lingual, or those of the mastoid region, and very few of opening the temporal. Should this, however, be deemed proper, and should there be no other way of drawing blood from the part to be benefited by the operation, the anterior branch of the temporal should be selected, and not the main trunk.

Operation. — The patient being seated, with the head supported, or else laying down, we feel for the pulsation of the vessel, about fifteen lines in advance of, and above, the meatus auditorius externus, where the artery is almost without the temporal fascia, close under the skin, and well supported by bone behind. Then, with a lancet or bistoury, we cut the vessel in half transversely, either by cutting from the skin inwards, or, what is better, from within outwards, as in Fig. 183, the instrument being previously introduced below the vessel. The artery should not be opened as the veins were, because the contraction of its muscular coat would tend to close the orifice, and stop the hemorrhage. As soon as the vessel is opened, the blood flies in a jet, and may be either received directly into a basin, or else drawn off by a bent card or trough, as in the operation on the jugular vein. Should the bleeding tend to stop before blood enough is taken, we should apply warm clothes to the part, wash out the clot, &c.; but if enough has been taken, compress the artery below the puncture, close the wound, apply a compress, and fasten it either by a simple circular bandage of the vault of the cranium, or by the knotted bandage, as before seen. We repeat, however, that the operation in the present day can hardly or ever be necessary, whilst the subsequent effects, from the formation of aneurism, or the scar from the tying of the vessel, are disagreeable and troublesome.

LOCAL BLOODLETTING.

The name of local bleeding is generally given to that in which the smaller vessels and those close to the diseased part are opened. This is

practised by means of leeches, cups, or scarifications.

LEECHING.

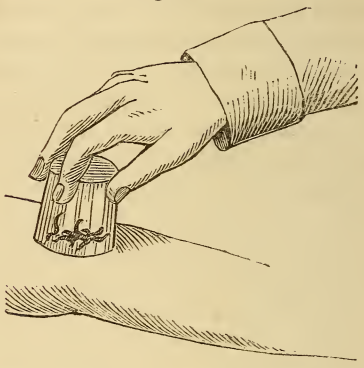
The leech is an animal of the intervertebrated articulated family Annelideæ, that has been employed in medicine from almost time immemorial. This species, *Hirudo Medicinalis*, is an aquatic worm, with a flattened body tapering towards each end, and terminating in circular flattened disks, the hinder one being the larger of the two. It swims with an undulating motion, and moves when out of the water by means of these disks or suckers, fastening itself first by one, and then by the other, and alternately stretching out and contracting its body. The mouth is placed in the centre of the anterior disk, and is furnished with three cartilaginous, lens-shaped jaws, lined at their edges with fine, sharp teeth, which meet so as to make a triangular incision in the flesh. It varies from two to three or four inches in its length, and inhabits marshes and running streams in most of Europe, and many parts of the United States.

Leeches afford the most effectual means of abstracting blood locally, as they are often applicable to parts which, from their situation or great tenderness, would not admit of the use of cups, and, in the case of infants, are always preferable to the latter.

In order to readily apply them to a part, care should be taken to free it, by washing, from all medicaments, and by shaving, from all the hair or down on the skin. If the leech is very active or hungry, it will readily attach itself to the part when thus cleansed, but generally, it is necessary

to moisten the surface with a little blood, or with milk, or with sugar and water, when the leech will readily leave the vessel containing it, and

Fig. 185.



attach itself to the skin. If it is desirable to attach it to a certain point, place it in a large quill or glass tube, and put this directly on the part, when, as the animal cannot escape, it will readily attach itself. But when the part is not so circumscribed, it suffices to apply the edge of the cup, holding them just below the part, and let them crawl on to it, or place them under a tumbler, which confines their wandering, and causes them to attach themselves to the part beneath.

Where blood is wanted to induce them to bite, it may be readily obtained by tying a string tightly round the extremity of the finger so as to render it turgid, and then lightly pricking it with a lancet; the blood escapes in points, and may then be smeared on the part. This operation causes no pain, unless very often repeated on the same finger.

Leeches continue to draw blood until they are

gorged, when they will drop off themselves; but if it becomes necessary to remove them before they are thus filled, it should be done by washing them with a little salt and water, and not by pulling them off, as this is very apt to leave the teeth in the wound, besides being destructive to the leech. Six American leeches are calculated to draw one ounce of blood; but as their bites frequently bleed as much as the animal itself drew, this is but an approximation of the quantity. Some persons are in the habit of cutting off the tail of the leech, in order to cause it to continue sucking for a long time, as the blood passes out as fast as swallowed; but it is a barbarous practice, and of course destructive to the utility of the animal. After the leech has come away, the bites continue to bleed, and this is often encouraged by the application of flannels, and cloths wrung out of hot water. But if we do not desire this extra amount of blood, cover their bites with a piece of linen moistened in sweet oil, or spread with fresh lard or cerate, to prevent its adherence to the wounds. Occasionally, it happens, in the case of children or weakly individuals, that the bleeding is profuse and debilitating. To arrest it under these circumstances, it is only necessary to touch each bite with a sharp-pointed piece of lunar caustic, which will arrest it almost immediately. A hot needle, stitches, &c., have been recommended, but the caustic is better, and more readily applied. In our large cities, where leeching is the peculiar business of a class of individuals, there is generally no difficulty in their employment; but with the country practitioner it is different, as he must pre-

serve and apply them himself, and this is thought to be very troublesome. Let it, however, be recollected, that their application is sometimes a matter of absolute necessity, that, as above shown, it is simple, and two of the objections to their use are removed. Their preservation is then the only point of difficulty. The leech, when gorged, remain inactive or unfit for use for several weeks, and is also liable to disease, by which numbers are lost. All that is necessary to guard against this, is perfect rest in a vessel of fresh water; in a few weeks they will again be fit for use. The preservation of them by the following rules is easy, and always ensures a supply. Never squeeze them to cause them to disgorge, it brings on disease; but place them in clean water, and change it frequently; a glass jar answers every purpose. Then, in order to keep them in health and ready for use, place them in a large tub or trough, six or seven inches deep, in a cool place, with a mixture of moss, turf, and fragments of wood at its bottom, with a few stones on this to keep it in its place. Place also, at one end, a piece of wood or earthenware filled with small holes and covered with a bed of moss, so that the leech may keep up its natural habits, and by drawing itself through the holes in the board or through the moss, sticks or stones, free itself from the secretion of slime found on its body, which otherwise becomes the cause of disease. By changing the water occasionally, and keeping the trough or tub covered with a piece of muslin in a cellar, any practitioner can always have a supply of these useful animals at his command. Let it be always recollected, however, that those which have been

used are to be kept separate from the others for about two months, when they may be replaced in the trough till again called for. If, in applying leeches to any point of the body whence they might escape to internal parts, as about the anus, the mouth, &c., they should remain in these parts, they may be at once destroyed and ejected by the free use of salt and water, either as an emetic or enema. The fear, also, of any internal injury from them is groundless, as the heat and other peculiarities of the parts will at once destroy them.

CUPPING.

By the word *cup*, is understood a little bell-glass, four to six inches high, from which we exhaust the air, so that when applied on the skin it may cause a congestion and rising of this membrane from the pressure of the atmosphere upon the parts around the cup itself. These cups differ chiefly in the manner in which the air within them is exhausted, some being slightly open at the top, and fitted to receive the end of a small air-pump, others being entirely closed and exhausted by the use of fire applied internally in different ways. When the flesh is cut previous to the application of the cup, the blood will flow freely from the incisions, when the exhausted cup is placed over them, though it did not do so previously. This is termed *cupping*, or the application of *wet cups*, in contradistinction to *dry cupping*, or that in which the cup is applied merely to irritate the part without any scarification or drawing of blood. When we desire to exhaust a cup, it may be done either with the pump, by fitting it to the cup as prepared for it, applying the latter closely to the part, and then working the

piston once or twice as in any ordinary pump, or by the use of fire to rarefy the air within the cup itself.

With this view, various means are employed. It may be rarefied either by the rapid insertion of a candle or little torch, and the instant application of the cup to the part, or else the fire may be placed in the cup and it at once put on the skin. To do this, some shake a little alcohol around the inside of the cup, pour out what flows readily, and inflame the little that adheres to the glass by a lighted piece of paper; others introduce small balls of inflamed cotton saturated with alcohol, others simply use pieces of burning paper; but the two last cause unnecessary pain, by burning the skin on which they fall. The best and neatest way of exhausting the cup, is the following. Cut several pieces of letter-paper slightly glazed into strips about one inch and a half wide. Wrap this round the end of the forefinger, so that about one-third of its width shall project beyond the end of the finger, and having thus formed a little tube, tear off the rest of the strip and twist the part projecting beyond the finger, so as to close up the tube and form a little cap like a thimble. Dip the open end of this lightly into alcohol, a small portion will adhere to its glazed surface, touch it in a candle, throw it into the glass, and apply the latter at once to the part. The shape of the cone is such that it will nearly always fall on its apex, or the twisted end, whilst the part wet with the alcohol, or the base, will stand uppermost and sufficiently far from the skin to prevent its being burnt. Having by either of these modes exhausted the cup, we allow it to remain on the surface of the part till the portion under it has become turgid, when, if blood is to

be taken, cut it by means of the scarificator, and reapply the cup as before, removing it when filled or half filled with blood, and reapplying it if necessary. In order to remove the cup, introduce the nail of the forefinger under its edge, and gently force the cup on to its side, so as to allow the air to enter. After wet cupping, the parts are to be cleansed, and covered with cerate or an oiled rag.

If the regular cupping apparatus, as furnished by the cutler's, is not at hand, we may perform the operation very well by using wine-glasses or tumblers, and scarify the parts if blood is to be taken by rapid punctures of a thumb-lancet, or a bistoury, or sharp penknife.

SCARIFICATION, OR FLY-BITES.

This is the name given to a number of light punctures, made by sticking a thumb-lancet into the skin in a great number of points, with a view of evacuating fluids beneath it, as in anasarca ; or of relieving inflammations or matter, as in erysipelas, abscesses under fasciæ, or effusion of urine from rupture of the urethra. No other precaution is requisite than not to plunge the lancet deeper than the integuments, and to do it rapidly, in order to save the patient unnecessary pain.

CUTANEOUS IRRITATIONS.

Another useful means of depletion, is by means of the cutaneous exhalents, in the establishment of serous or suppurative discharges by frictions, blisters, setons, issues, and moxas.

In Frictions, some irritating ointment or liniment is thoroughly rubbed on the part, either to

redden it, or to produce serous discharges from blisters.

In Blistering, the cutis is raised up by the accumulation of serum produced by the application of Spanish flies, &c.; after which the cutis is opened or cut away with sharp scissors, and the raw surface dressed by mild or stimulating ointments, according as it is desired to heal it up or keep it open.

SETONS.

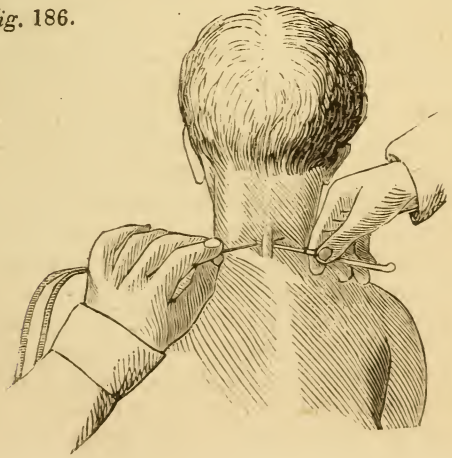
A seton is one of the most powerful means of keeping up a cutaneous discharge. Strictly speaking, the seton itself is merely the band or substance employed to irritate the part, though the same name is given to the operation by which this band is introduced beneath the skin. Its seat is now very generally confined to the back of the neck, though it may be also applied to certain other parts, as the fleshy part of the thigh or arm; but for these points, issues are more generally preferred.

In order to apply a seton, we require a sharp cutting instrument to make an opening through the integuments, and some strip, which, when introduced, will, by its irritation, keep up a suppuration from the parts. For the insertion of it we have two instruments, Boyer's seton-needle, and a common straight bistoury and eyed probe.

The first consists of a flat steel blade, about five inches long, six lines wide, and perforated at one end with a hole large enough to receive the strip to be introduced; the other end is sharp, and sloping to a point like a thumb-lancet. To introduce a seton with this, first fasten the substance to be used in the eye of the needle, and then seizing a portion

of the integuments of the required width between the forefinger and thumb of one hand, raise it up from the parts below, and transfix its base by forcing the needle through, and drawing it and the seton out on the opposite side to that on which it entered, so as to leave the seton in the wound, after which its ends are to be fastened down to the part by a little piece of adhesive plaster, and the whole covered for the first three days by a warm poultice, till suppuration commences, when a simple dressing is all that is requisite. The objections which we have to this method are, that the seton-needle is not always at hand, that the fastening of the seton in its eye makes a thick mass, which passes through the opening with difficulty, and that it is hard to hold the point of the needle, when wet with blood, so as to draw it through; we much prefer the straight bistoury and eyed probe. To use this, fix the seton by a thread to the eyed

Fig. 186.



probe, seize the integuments as before, cut them with the bistoury, and before removing it, introduce the point of the probe from the opposite side, and withdrawing it and the bistoury at the same time, insert the seton in its place.

In respect to the substance of the seton, there is much diversity of opinion, as has been already shown under the head of dressings, Figure 24. But let the substance be what it will, it must always be well anointed with ointment previous to its introduction, in order to facilitate the entrance, and also previous to any movement of it through the wound in subsequent dressings. For the first three days the poultice is stained by blood, or slight oozings, but afterwards by pus. When suppuration has freely commenced, the substance of the seton becomes charged with matter, which, if allowed to remain, becomes very offensive. At each daily dressing, therefore, the seton is to be drawn through the wound till this soiled part is free, when it is to be cut off, and the ends fastened down and dressed as before with simple dressings, confined by a circular bandage of the neck, as at Fig. 34, or by a sling, as at Fig. 92. As the seton by this operation is soon cut up, it will be necessary to prepare for the introduction of a new one. This is readily accomplished by attaching it by a few stitches to the old one, anointing it well, and drawing this into its place as the old one is removed. A skein of saddler's silk, or a piece of silk braid, is the kind most frequently employed, but where we can obtain a strip of gum-elastic, or a braid or tape coated with it, it will be found to be much more cleanly than the former. For the cases requiring the use of the seton, and for the

period of its duration, we must refer to other works.

ISSUES,

Are intended to relieve different portions of the system, either by acting as drains, and thus depleting, or as counter-irritants, where a long-continued inflammation is desired, as in the treatment of caries of the spine, neuralgia, chronic insanity, &c.

Issues are made in two ways: either by the destruction of the integuments from the action of a powerful caustic, or by incising them and preventing their subsequent union.

To make an issue by the first means, lay upon the part a piece of diachylon plaster, or kid spread with soap cerate, and having in its centre a hole of the size desired for the issue, generally about two lines in diameter. Rub the integuments within this hole with a piece of caustic potassa, till they become black, and repeat the operation each day till we attain an eschar of the desired depth, generally not deeper than the integuments. Or, place in the hole in the plaster, a piece of potassa of the size of a hemp-seed, and cover the whole with another piece of plaster, a small compress, and a bandage. After twelve hours remove these, and apply a small warm poultice to hasten the separation of the slough. When the slough come away, we have a deep circular ulcer, which is to be filled by three or four peas made of Orris, or some other porous root, and dressed with cerate, or basilicon, or mezereon ointment, according to circumstances. The subsequent

dressing, usually daily, will also depend on circumstances; fungous granulations are to be removed by caustic, suppuration kept up by moving the peas, or, if it is desired to heal it up, by removing them and using simple dressings. Issues may be made in any part of the body, provided there is sufficient depth of cellular substance below to keep up a free discharge, and no joint, vessel or bony surface sufficiently near to be injured by the caustic. Washing the part with vinegar will at any time stop the action of the potassa. If nitrate of silver is used, wash with salt and water; and if sulphuric acid, with magnesia, or some other alkali.

MOXA.

This is the name given to little rolls of inflammable matter, which are intended to cause eschars and subsequent issues, by being allowed to burn upon the integuments until they cause its destruction. These are made of various substances, as cotton, lint, tow, &c., soaked in a saturated solution of nitre, dried and then wrapped up in little bags; or, rolls of silk, or muslin, sewed together at the sides, or formed into rolls and coated with gum; or we may use the common punk, as found in sticks in the tobacconists, cut into pieces about one inch long. The application of any of these cylinders is very simple. Having chosen a spot where the subjacent parts of importance are not likely to be injured by the extension of the inflammation, place upon it a piece of moistened cloth, with a hole in its centre large enough to receive

the moxa. This cloth is intended to preserve the surrounding parts from the sparks which sometimes escape. Next see that the end of the moxa is applied to the body flatly, so that it may fit itself accurately to the surface, and moisten it with a little gum to make it adhere ; or else hold it firmly on the part, by a pair of forceps, or a porte-moxa or metallic ring, as in the figure. Having now lighted one end of the cylinder, keep up the combustion by the breath or a pair of bellows ; the

Fig. 187.

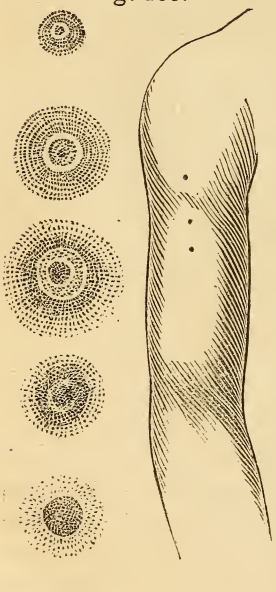
latter is necessary where its smoke irritates the bronchia too much. In its burning, the patient first feels a gentle heat, which gradually increases until, as the fire approaches the part, the pain for

the moment becomes excruciating, and destroys entirely the vitality of the part. The eschar thus formed is then treated like the eschar formed by the caustic in the issue, and the subsequent treatment will be also similar, to what has been there said.

VACCINATION.

The introduction of the vaccine is to be accomplished by a slight puncture with a thumb-lancet through the cutis only; or by removing the cutis by a blister, and rubbing it on the denuded surface; or by making four or six incisions with a lancet through the cuticle, crossing these by other lines, and introducing the matter under the angular points of skin thus made, and letting it dry before the clothes can rub it. The latter should be kept from irritating the sore throughout the treatment. The figure shows the appearance three days after the puncture; the appearance of the scab at the seventh day, at the eighth, ninth, eleventh, and twelfth, but, of course, imperfectly, it being impossible to do more here than hint at the appearances.

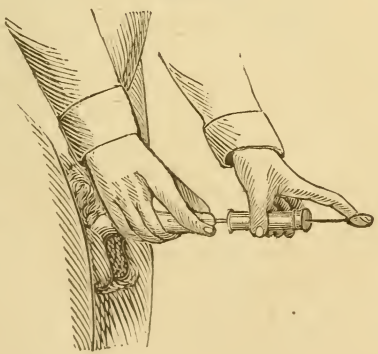
Fig. 188.



INJECTIONS.

These are practised upon various parts of the body, as in the Lachrymal Ducts, the Rectum, the Urethra, and the Vagina. For the first we require an Annesly's syringe, and such a knowledge of the part as may be best gained from the various works on the eye. Enemata, or injections into the rectum, are more common, and though generally performed by the attendants, yet often fall to the lot of the young practitioner either to direct or to perform. In order to give one without causing pain, especially if a patient have hemorrhoids, oil the forefinger of the left hand and introduce it within the sphincter ani, and passing the oiled end

Fig. 189.



of the syringe along this as a director, carry its point in the line of the curve of the sacrum. Injections into the urethra are most frequently prac-

tised by the patients themselves, but few, if any, do them properly. As much of their success depends on this, special directions should always be given. Let them, therefore, be told, to proceed thus: Fill the syringe, and insert its end gently within the urethra, closing the orifice around its point, as in Fig. 189. Then sitting down on the edge of a chair or bed, or upon a ball made by rolling up a handkerchief, so as to press on the perineum, throw the fluid in by a motion of the piston, as in the figure, and withdrawing the instrument, close the urethra, and hold the injection for a few minutes. In injections into the vagina, let the patient *lay down* on the back with the hips raised by a pillow, use a female syringe, and retain the fluid by cloths, &c., as long as possible.

TOOTH-DRAWING.

The surgeon is occasionally called on to extract teeth, in the performance of operations on the jaws, or in country-towns, &c., where there are no regular dentists, but, except under such circumstances, it should be avoided, it being generally considered as derogatory to his higher and more important position. We, therefore, shall be very brief in our remarks on this subject. The simplest method of extracting any of the teeth, except the incisors, is by the use of the key. To operate with this, lance the gum thoroughly all round the tooth, to free it from its adhesions; and having surrounded the fulcrum of the key with a few turns of a roller, to prevent its injuring the soft parts, place it

on the *inside* of the tooth that is to be drawn, a little below the level of the alveolar process, and fix the claw on the outside of the crown of the tooth, where the gum joins it. Then grasping the handle of the instrument firmly in the hand, rotate it slightly to fix the claw on the tooth, and then by a quick movement of the wrist in rotation turn the tooth out of the socket. Sometimes the claw alone extracts it, but frequently, it merely bends it over, and we have to extract it by a slight rotatory and drawing movement of the forceps, drawing it upwards and inwards in the line of insertion of the tooth. For the extraction of the incisors, lance the gum as before, and seizing the tooth in the forceps, pull downwards, or upwards and inwards, varying with the upper or lower jaw, giving also a slight movement of rotation. We must take care not to close the forceps too firmly on the tooth, as this will sometimes cut the tooth short off at the gum, leaving a stump in the socket.

There are many other duties which fall upon the young surgeon, but they are generally included in a course of lectures on surgery, and as they would enlarge our pages beyond proper limits, we are compelled to pass them by.

THE END.

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